



Industrial and urban impact on heavy metal content in salt marsh soils from southwest of Pontevedra province (Spain)

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Marshes are an important part of the fluvial, estuarial, and coastal ecosystems. The short-term residual spills effects on marshes depends primarily on the vegetative responses and the long-term effects depend of the response of the soil microbial community which depends, in part, on the content of heavy metals in marsh soils. The organic matter accumulated by superficial deposition of marsh grass detritus and effluents is very important to the fate of trace metals. The oxidation status of soils and sediments affects the distribution of some trace metals between bound, unavailable, soluble and available forms. The combination of anaerobic conditions and high organic matter content makes the salt marsh environment ideal for bacterial sulphates to sulphides reduction. This process plays an important role in the development of marsh sediments and in the control of heavy metal solubility. The objective of this work was investigating the effects of the industrial and urban spills on the marsh soils heavy metal contents.

The studied salt marsh is located in southwest of Pontevedra province, Spain. The area is very next to the city of Vigo (300,000 inhabitants) and to an industrial complex whose raw materials and final products can contaminate the surrounding areas via atmospheric pollution and effluents, because many spills reach the river that forms the salt marsh. To establish the effects of waste disposal on the nearest marsh soils, ten sampling points in the salt marsh were selected randomly and, in them, topsoil samples were taken bimonthly, during a year. Later, the physicochemical characteristics of the soil samples, and heavy metal contents were analyzed and a comparison was made to control samples. Sampling was carried out from surface horizons (0-25 cm) of ten

Thionic Fluvisols located in the southwest of Pontevedra province, Spain. Five samples of each site sample were taken and stored in polyethylene bags. The samples were air dried, passed through a 2 mm sieve and homogenized and five subsamples were taken for the analyses. The samples were analysed by particle size distribution, pH, Eh organic carbon, N, P, and K content, C/N ratio, cationic exchange capacity (CEC) and exchangeable cation contents. The available Cd, Cu, Pb and Zn content was extracted using the DTPA method. Total contents were extracted by means of acid digestion using a mixture of nitric, hydrochloric and hydrofluoric acids in Teflon bombs placed in a microwave oven. The analysis of Cd, Cu, Pb and Zn was carried out by ICP-OES (Perkin Elmer Optima 4300 DV). The efficiency of the extraction and analysis procedures were controlled by analysing international standard reference material of marine sediment from estuaries such as MESS-3 (10 repetitions for each element) from the Marine Analytical Chemistry Standards. Program of the Canadian National Research Council (Ottawa, Canada), the procedure as described MESS-3 is estuarial sediment characterised by a low average metal concentration, making the sediments an appropriate tool for the analytical control of the samples from the Galician marshes. The results were the average of these five calculations and were expressed on a dry material basis. The relationship between the different variables was evaluated by a simple correlation and regression analysis.

The influence of spills can be seen clearly, since in normal environmental conditions the soils of the area have a low content of heavy metals. The concentrations of all metals in every surface horizon surpass to those indicated by the bibliography for the background concentrations in Galician coastal sediments. The soil content of DTPA-extractable metals was generally low and closely correlated with total content. The soils affected by spills show considerable Cd, Cu, Pb and Zn total contents. The relationship established between the oxidation-reduction potential and the Cd, Cu, Pb and Zn total contents shows that when there is a larger reduction, the metal contents increase because they remain in the soil as precipitated sulphides. Highest concentrations occur under reduced conditions, gradually decreasing when they change to oxidant values. Several authors found that soluble heavy metals were hardly affected by the oxidation-reduction potential except at intermediate oxidation-reduction potentials similar to those found in the soils studied in this paper.