Anthracene and lead adsorption on a Portuguese soil – competitive studies

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Abstract

The environmental contamination by organic and inorganic chemicals has been, for a long time, one of the most common problems in soils and sediments.

Many organic chemicals, such as polycyclic aromatic hydrocarbons (HPAs) can persistent in soil environment for a long time (Sabljic, 2001). Due to the possibility of ring fusion at different positions, there are more than 100 HPAs that are recognized by IUPAC (Jacques et al., 2008).

Some inorganic elements like heavy metals are natural constituents of soils. Due to anthropogenic activities, significant changes occurred in the global account of these metals at the earth's surface (Serrano et al., 2005).

Anthracene and lead were selected as they can be found as co-contaminants in storm water (Lau and Stenstrom, 2005) or in petrochemical industries or oil refining products and waste. They can also result from incomplete combustion of organic substances as coal, oil, gas, wood and garbage (Jacques et al., 2007).

Sorption is a key process controlling mobility, bioavailability, toxicity and fate of pollutants in soil (Chen, 2007). As a consequence, this study was conducted in order to assess the partitioning of anthracene and lead on a Portuguese soil, in single and competitive systems.

A sample of a loamy sand soil was collected in Oporto, Portugal (41º25'15.58"N and 8º45'58.27"O) (Fonseca et al., 2008). Batch tests were performed in order to evaluate de adsorption kinetics and equilibria. For the equilibrium tests, single or multi solutions containing anthracene and/or lead with different concentrations, were prepared in 0.01 M $CaCl_2$. Then they were added to 2 g of soil, and the systems were shaken at 100 rpm for 72 h, at room temperature. Kinetics was evaluated for contact times up to 72 h, after soil sample saturation and addition of stock solution.

Lead concentration in the liquid phase was quantified by atomic absorption spectrometry (Spectra AA-400). After the addition of deuterated phenanthrene to the samples, anthracene was determined by gas chromatography – mass spectrometry (Varian 4000). The quantification of anthracene was performed using external standard calibration (Domine, 2007).

Kinetics and isotherm equations were fitted to experimental data in order to describe the adsorption process of the anthracene and lead, in competitive and non-competitive systems.

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