Desorption kinetics of phenantrene and lead from a contaminated soil

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Oral presentation

Heavy metals and polycyclic aromatic hydrocarbons (PAHs) exist naturally in soils in acceptable concentrations. However, recent studies proved the simultaneous accumulation of PAHs and heavy metals in soils surrounding urban complexes, gas stations, metalliferous mines, coking plants and major roads [1]. Therefore, it is important to predict and prevent the transport of these contaminants through soils. Various studies have been made in order to describe the sorption kinetics and equilibrium of different contaminants [2], but little attention is paid to desorption processes and their enhancement. To our concern this is a very important issue, since the (bio) availability of theses contaminants depends on desorption and consequently affects the efficiency of a (bio) remediation process.

The objective of this experiment is to evaluate the influence of simultaneous contamination in the desorption kinetics of heavy metals and PAHs. Phenantrene and lead were chosen as representative contaminants of each class. A soil historically contaminated with 5000 mg/kg of Pb, spiked with phenantrene, was used as soil specimen. Soil sample was allowed to contaminate for more than one week. Batch desorption tests were performed using different desorption solutions, in order to evaluate and compare their efficiency. Namely, deionised water, solutions of ethylenedinitrilo tetraacetic acid disodium salt (Na-EDTA), polyethylene glycol dodecyl ether (Brij® 35 P), polyethylene glycol sorbitan monooleate (Tween® 80), and composed solutions of Na-EDTA/ Brij® 35 P and NA-EDTA/ Tween® 80.

The experiments were carried out in flasks containing 2 g of soil and 10 mL of desorption solution, agitated in a shaker at room temperature for different contact times. This method allowed keeping the equilibrium undisturbed. The pH of the supernatant was measured after centrifugation of the samples. Proper duplicates were undertaken.

The experimental data from each desorption run were fitted by commonly used kinetic models like Elovich, Lagergren, Second Order Equation and an Empirical Power function. The tested solutions showed very high efficiency desorbing both contaminants, comparing to water. Hence, there are good perspectives in the application of these solutions as enhancers of remediation processes.

References

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