

It is widely accepted that, when an electrokinetic remediation (EKR) is performed for the cleanup of most toxic metals, an enhancement is needed. During the unenhanced EKR the reactions at the electrodes, probably water electrolysis, result in the production of hydroxides, at the cathode, and hydroniums, at the anode, that migrate towards the opposite electrode. Most toxic metals are recovered as cations, and in their way towards the cathode will meet the hydroxides, with different problems arising. The most typical enhancement is the addition of an acid over the catholyte, which results in the replacement of the hydroxides for the corresponding anion of the specific acid. This anion will also migrate towards the anode, so the decision about which acid should be used can be quite important. Several previous works have tried the use of acids of different strength, but no definitive conclusions have been derived from these works, probably due to the experimental procedure used. Most research at the lab scale is performed at constant voltage drop, which is a reasonable decision based on the most likely design at the field scale. Nevertheless, the obtainment of reproducible results is difficult with this design because, at any time, a small difference in the conductivity will lead to an increase of the amount of hydroniums that will enter the soil, and this will feed back the initial difference of conductivity, leading to the divergence of the results. Instead, the use of a lab design based on constant current intensity allows a very good reproducibility, mostly when the experimental work is performed in different columns connected in series. For these cases, one can be sure that the amount of charge circulated through the soil is exactly the same for both columns, and is directly proportional to the experimental time. We have applied the acid-enhanced EKR to a real soil with an important lead pollution (4.5 % of the dry mass), which was obtained at 400 m downstream of the slag heaps of a lead mine of Linares (southern Spain). This soil is alkaline and has an important amount of carbonates (8.5 %). We have tried nitric and acetic acids and both experiments were duplicated. All the experiments were ended once a 30 % of the initial lead was removed. A BCR sequential extraction procedure was performed in a “before and after” way to analyze the changes on the mobility that occurred during the remediation. The soil samples after the treatment were split into two slices, to observe the differences that could arise between the soil regions closer to each electrode compartment. The results indicate that the reproducibility of the duplicates is very good. Also the BCR results obtained for the treated soil were quite similar for both acids, indicating that, by the time we decided the end of the experiments, more than 90 % of the lead was removed from the soil closer to the anode, an important accumulation is found in the soil closer to the cathode and the distribution of lead among the different fractions of the BCR was not depending on the acid selection. Nevertheless, the acetic acid required a larger amount of moles, but the time (and charge circulated) required for the same remediation efficiency was more than double for the nitric acid, due to the formation of acetic acid resulting in a larger fraction of the electric current being transported by the remaining ions.