

COPPER CONTAINING MINERALS BEFORE AND AFTER ELECTRODIALYTIC REMEDIATION

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Electrodialytic remediation (EDR) is a method that has proven to be useful for the remediation of soil polluted with heavy metals (HANSEN et al., 1997; KLIEM et al., 1999). Earlier experiments have shown that addition of reacting agents will improve the electro-dialytic soil remediation process (e.g. OTTOSEN et al., 1999).

Soil polluted with copper has been investigated. The pH of the soil was 7.5, content of carbonates was 12%, and the copper concentration 20000 mg/kg DM. After remediation, the copper concentration was 1050 mg/kg DM. The soil was investigated by different analytical methods: scanning electron microscopy (SEM), connected to an EDX-analyser, X-ray powder diffraction (XRD), and X-ray absorbance fine structure (XAFS).

Sample of the soil <250 μm showed that copper could be found in mainly three different phases. The first phase showed almost pure copper in EDX spectra (H, C and O cannot be detected) and minor amounts of Zn, Fe, Al and Si, in the second phase Ca and Cu were found together, and in the third phase copper was found in particles in connection with Si and Ca. When a separation of the particles <20 μm was made, only the first copper phase was found. Here copper was found in spherical particles, which were hollow. These particles were most probably malachite also found in XRD and EXAFS. In the sample remediated as much as possible by EDR, copper could not be found as malachite, which contained the main part (90%) of copper before remediation.

SEM analytic methods showed that copper in the untreated soil was situated as pure copper (H, C and O were not included), and XRD showed that copper was bound in copper hydroxycarbonates. EXAFS measurements verified these results, as they showed a good agreement between the pure copper hydroxycarbonate reference and the soil sample. EXAFS showed no significant peaks for copper hydroxycarbonates in the soil that was remediated by the EDR technique. This means that the copper hydroxycarbonates were the part of the copper that was remediated, and the remaining copper was situated in some other minerals, which are obviously more difficult to extract. The main problems seem to be the possibility of slow kinetics of the reaction between the copper compounds and the desorbing agent, and the risk for no reaction.

References

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