DTU Byg
Institut for Byggeri og Anlæg

INNOVATION DAY 2013

Fig 1: Soil contaminated by CCA impregnation of wood

Environmental electrochemistry

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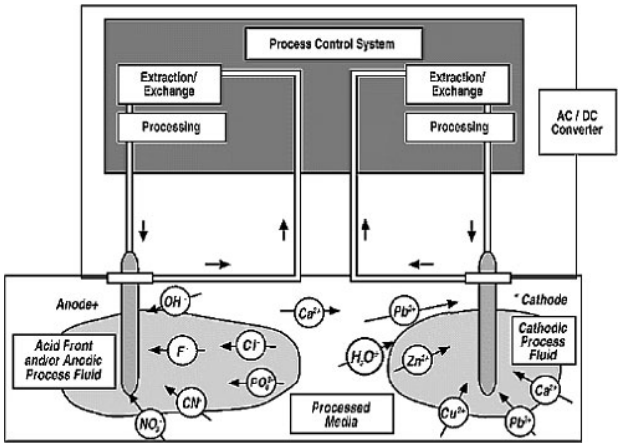


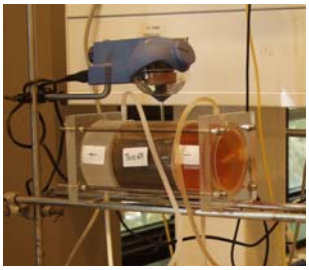
Fig. 2: Illustration of electrokinetic in situ principle from http://www.itrcweb.org/

Electrokinetics

•First developed as a remediation method for treatment of soil contaminated by heavy metals.
•Treat the soil in situ by placement of electrodes in the soil, and passing a low voltage direct current between cathodes and anodes as illustrated in figure 2.
•By the electrode processes, acid is generated at the anode and hydroxide ions are released at the cathode. As most heavy metals become less mobile under alkaline conditions, acid must be injected at the cathode to obtain an efficient remediation.
•The process works, and has been implemented in large scale, however it is a rather slow method which is mainly suitable for in situ treatment of soil below houses, where it is more urgent to preserve the house and undisturbed daily life rather than removing the contaminants fast.

Development of electrodialytic treatment at DTU Byg

•At DTU the electrodialytic remediation method was developed.
•By this method ion exchange membranes hinder the electrode products in entering the soil during treatment, and a higher current efficiency is obtained by this means.
•In some cases, where contaminated soil is excavated and a fast treatment is preferred, separation of coarse grains and soil fines in a washing process may be preferred: The contaminants will remain in the fine fraction which can then be treated by electrodialysis in a suspension as shown in figure 3.
•By this process the volume of material to be treated is reduced significantly, and the treatment is enhanced due to shorter transport distance of the contaminants in the suspension.



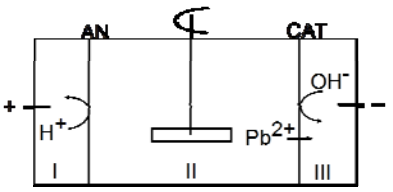


Fig 3: Picture and schematic diagram of electrodialytic treatment. The material to be treated is placed in compartment II. If the material is fine grained enough it can be treated in a homogenous suspension illustrated by the overhead stirrer.

Fig 4: Pilot scale setup developed at DTU Byg for investigation of continuous treatment of various fine grained materials.

Documented potentials of electrodialytic treatment.

• Upgrading of hazardous materials to materials suitable for production of construction materials.
•Extraction of depleted key resources such as phosphorous from waste materials.
•Extraction and concentration of valuable elements such as copper from waste materials.
•Detoxification of: harbor sediments, freshwater sediments, mine tailings, ashes, flue gas cleaning products.

Other applications for electrokinetics:

• Electrokinetic fences for control of e.g. runoff water from mine tailings.
•Dewatering of fine grained materials (electroosmosis)
•Removal of damaging salts from constructions and cultural heritage.

Fig. 5: Electroosmosis: water is extracted from materials with fine pores by application of direct current. In contrast to other dewatering methods the efficiency increases with decreasing pore size.