Remediation of the residual sludge from soil washing

A possible solution for heavy metal contaminated soils

And mixed contaminations?

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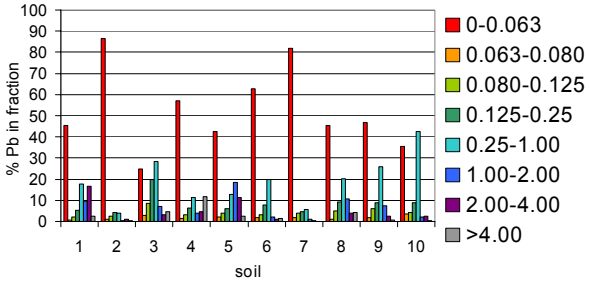
Content

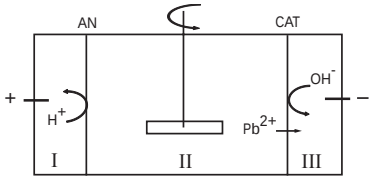
- The concept of soil washing
- Treatment of the sludge
- Remediation results for Pb
- Central questions
- And answers
- Perspectives

Soil washing: concept and challenges

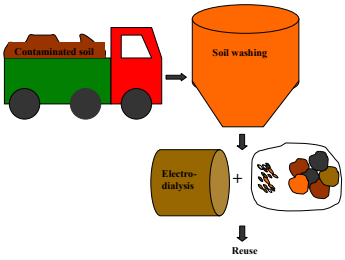


Pb clearly concentrates in the fine fractions of most soils (sizes in mm)

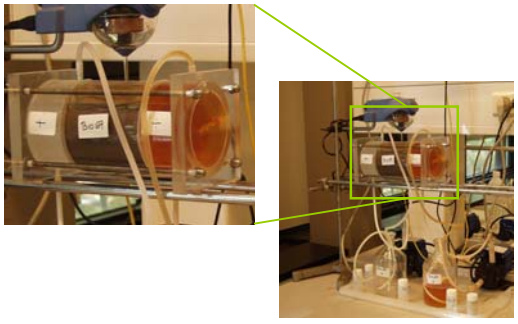
Electrodialytic remediation



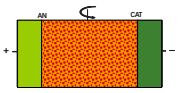
Soil washing: Solutions

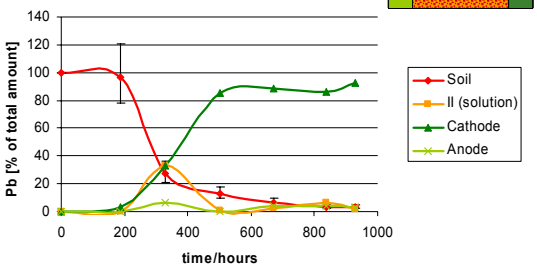


Electrodialytic remediation:



Remediation results for Pb:





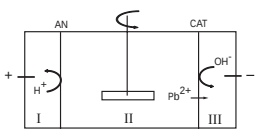
Initial Pb concentration: 673 mg/kg DW Final Pb concentration: 23 mg/kg DW

Central questions

- Is 800 hours of residence time realistic?

Answers: residence time

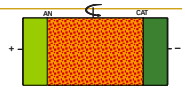
- The necessary residence time may be reduced by:
  - Continuous pH adjustment in catholyte
  - Holding a constant voltage
  - Nitric acid addition
  - Increasing the membrane area pr. volume of sludge

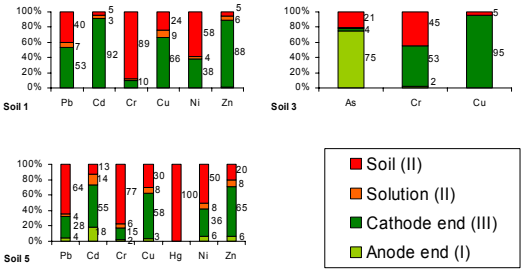


Central questions

- Is 800 hours of residence time realistic?
- How does it work for other elements?

Answers: other elements



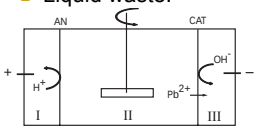


Central questions

- Is 800 hours of residence time realistic?
- How does it work for other elements?
- How much liquid waste is produced?
- Energy consumption?

Answers:

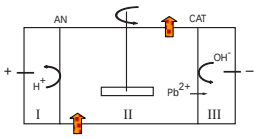
- Liquid waste:



- Energy consumption:

Answers:

- Liquid waste

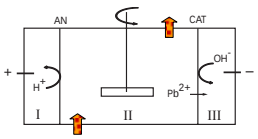


Electrolytes are recirculated
Liquid in II may be reused for washing (acidic)

- Energy consumption

Answers:

- Liquid waste



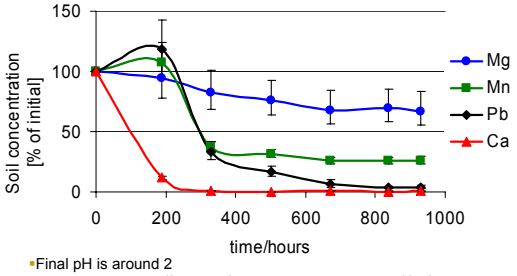
Electrolytes are recirculated
Liquid in M may be reused for washing (acidic)

- Energy consumption
  - Based on laboratory scale experiments a conservative estimate is 0.24 kWh/kg soil (DW)
  - 30% ends up in sludge fraction
  - 17% carbonate
  - Reduce conc. to 40 mg/kg

Central questions

- Is 800 hours of residence time realistic?
- How does it work for other elements?
- How much liquid waste is produced?
- Energy consumption?
- What is the condition of the soil after remediation?

Answers: final condition of soil



- Final pH is around 2
- K, Al and Fe less affected – final concentration is > 90% of initial
- Altogether 20% of the soil was dissolved – 17% was carbonates.
- Soil may be almost completely reconstituted by addition of lime.

Perspective

- Up scaling
- Organic contaminants: Chlorinated solvents, PAH's, aromatics….
- Reuse