

Electrokinetic enhanced bioremediation of organic contaminants in groundwater

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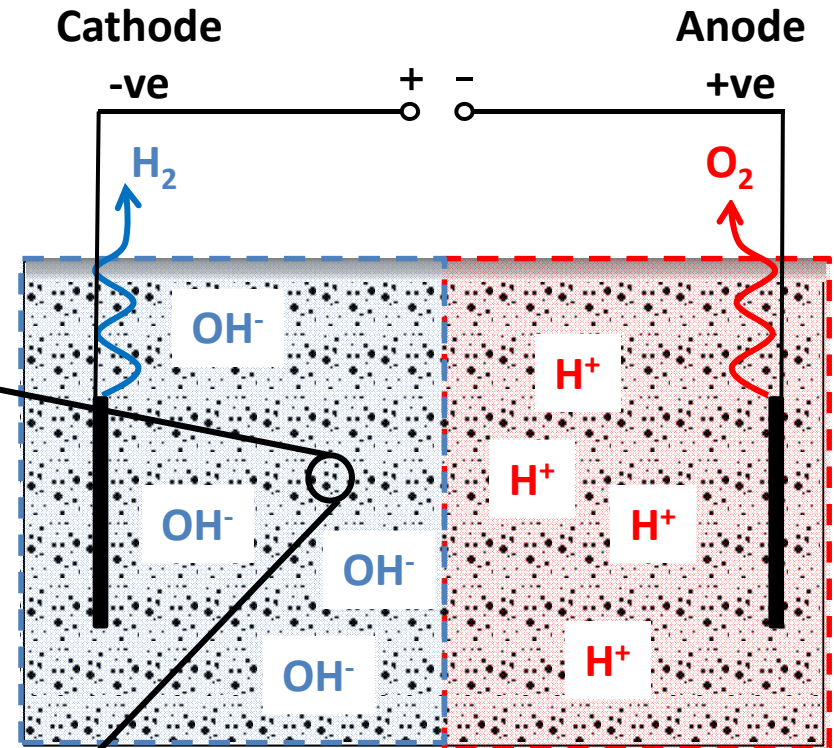
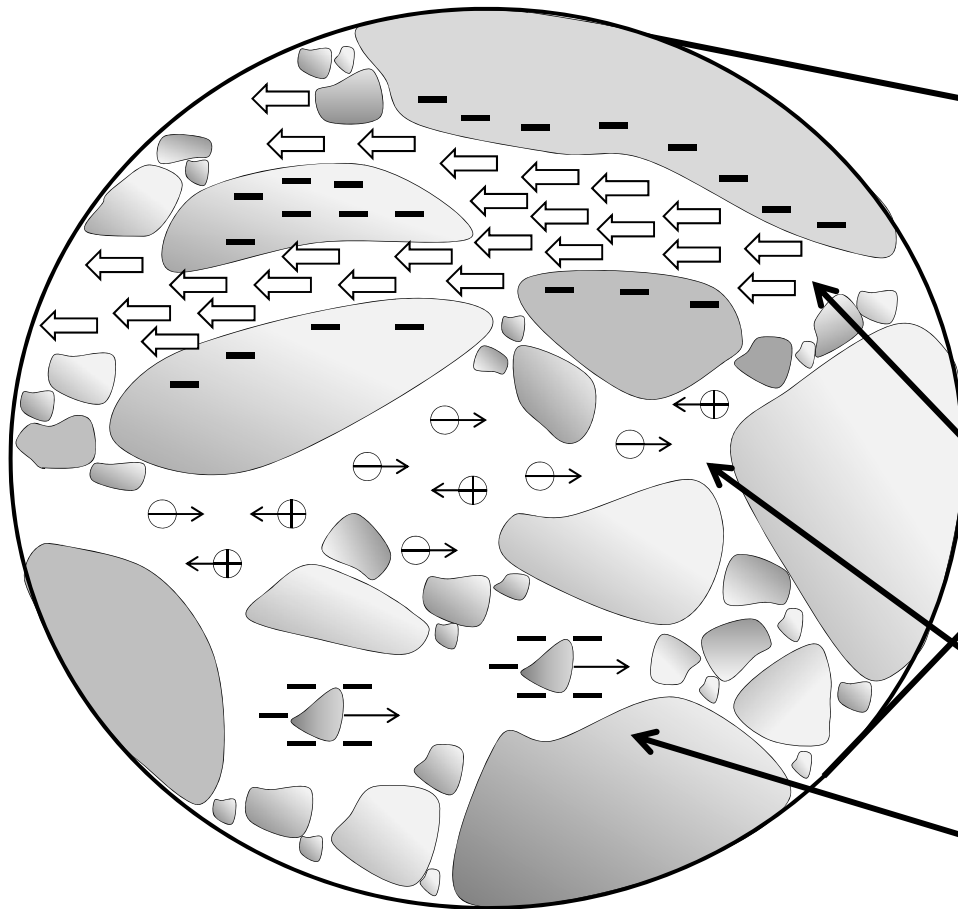
The
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Sheffield.

EPSRC
Pioneering research
and skills



What is electrokinetic remediation?

The application of a direct current to remove organic or inorganic contaminants from the subsurface.



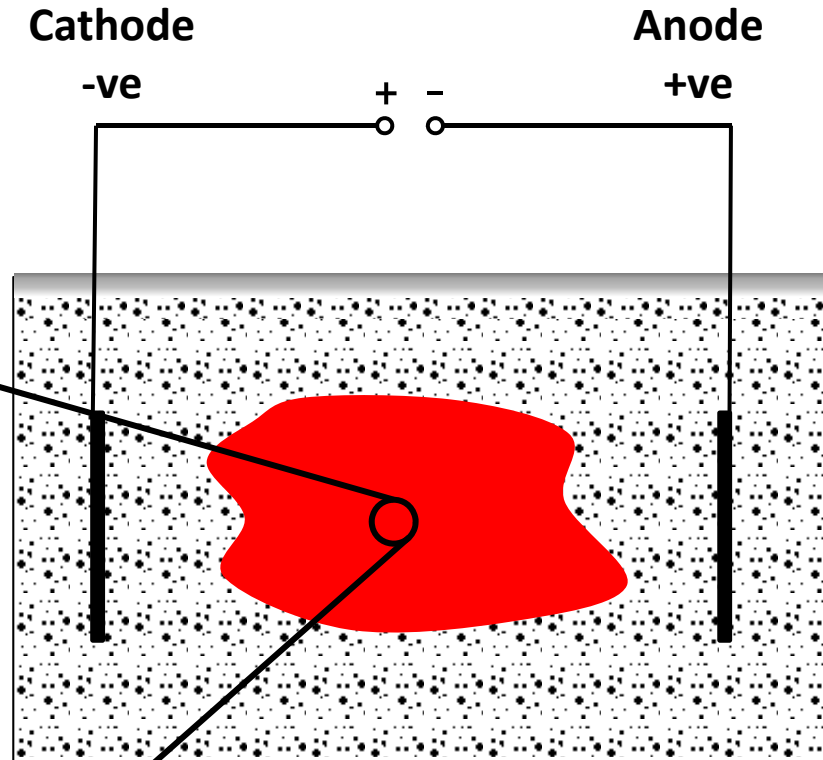
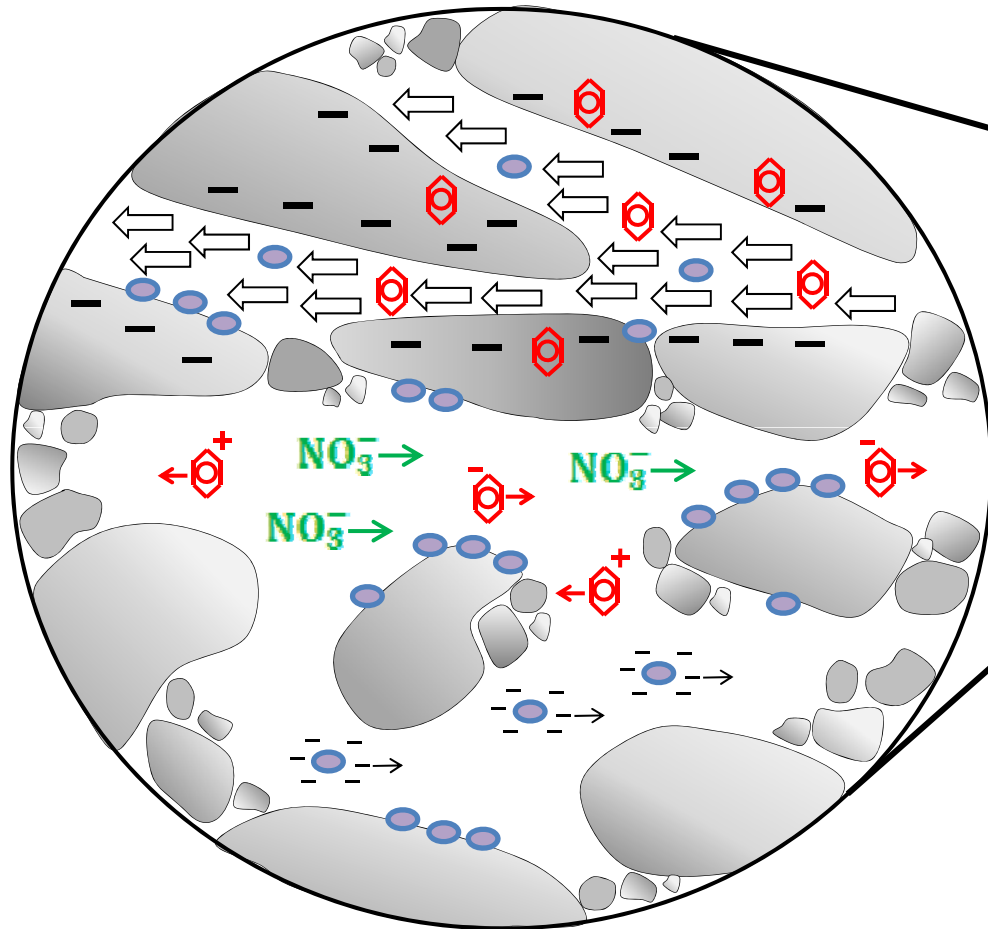
Electroosmosis → Surface Charge

Electromigration → Voltage

Electrophoresis → Particle Charge

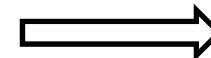
How can EK enhance bioremediation?

Transformation of contaminants by microorganisms into less harmful substances



EK-BIO function

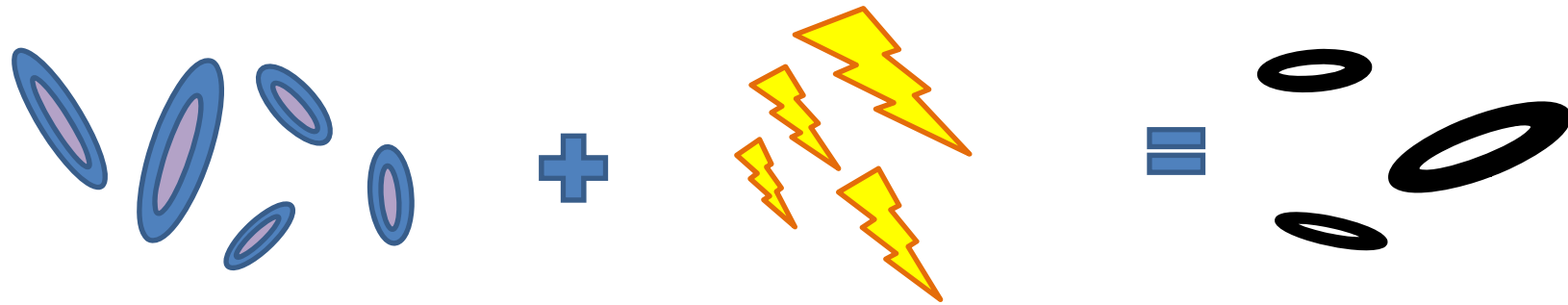
Growth Factors



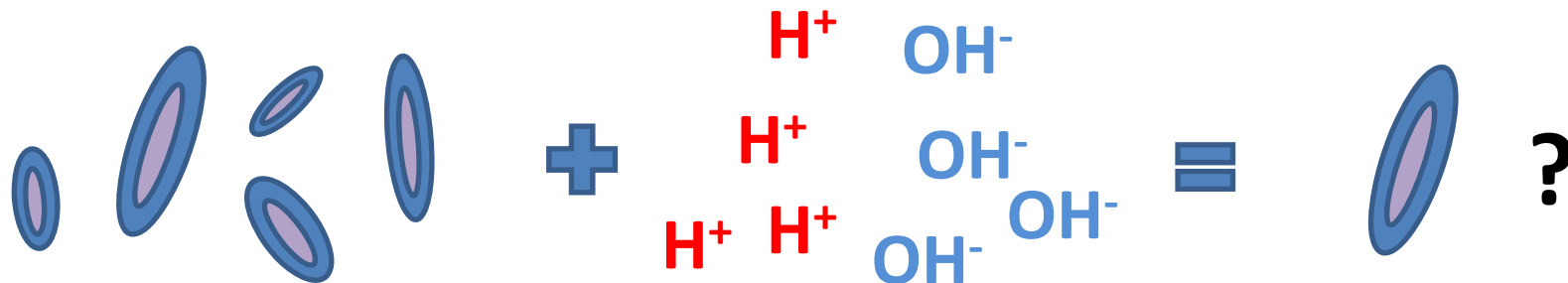
Enhanced Availability

What effect does EK have on microorganisms?

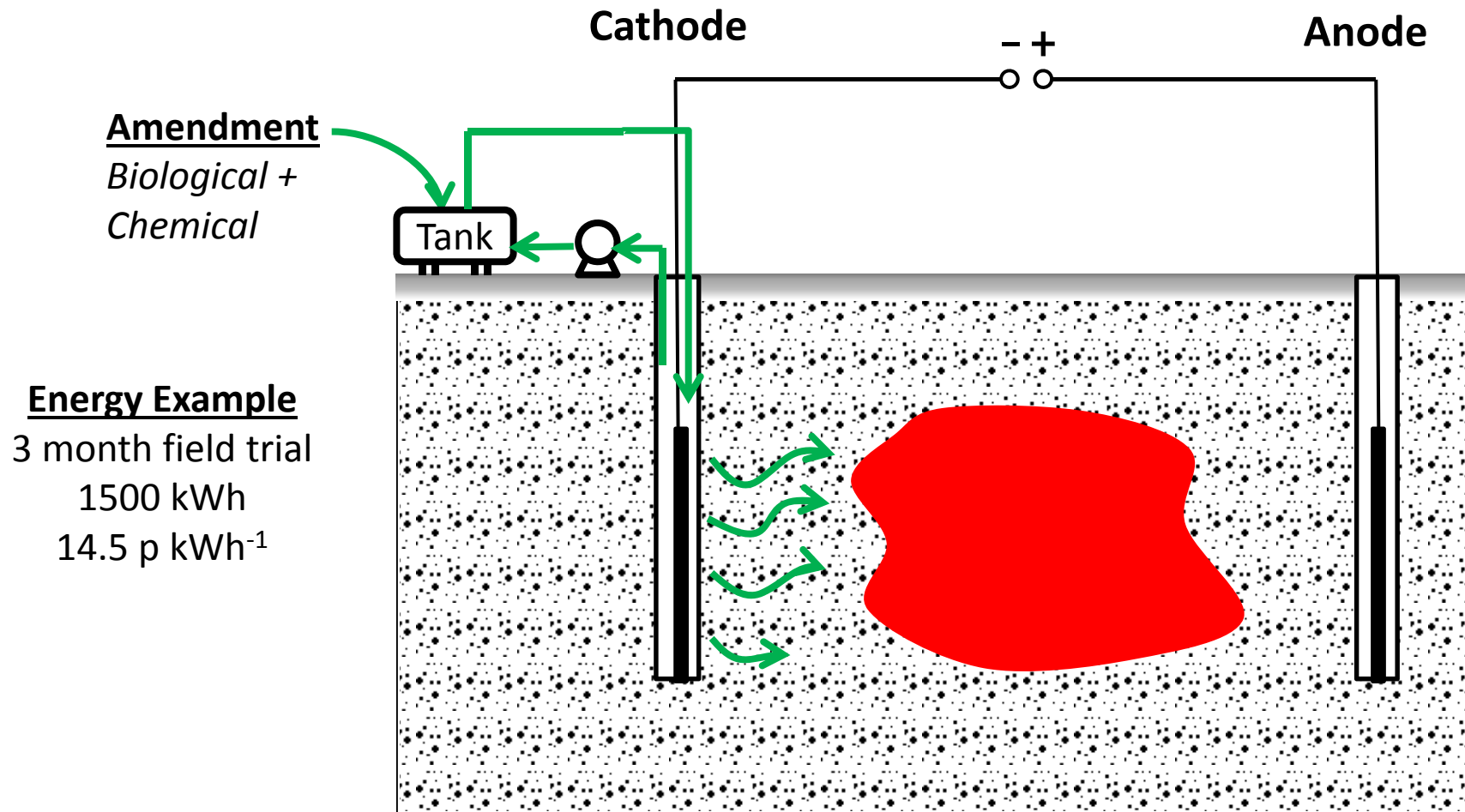
High Intensities



Low Intensities

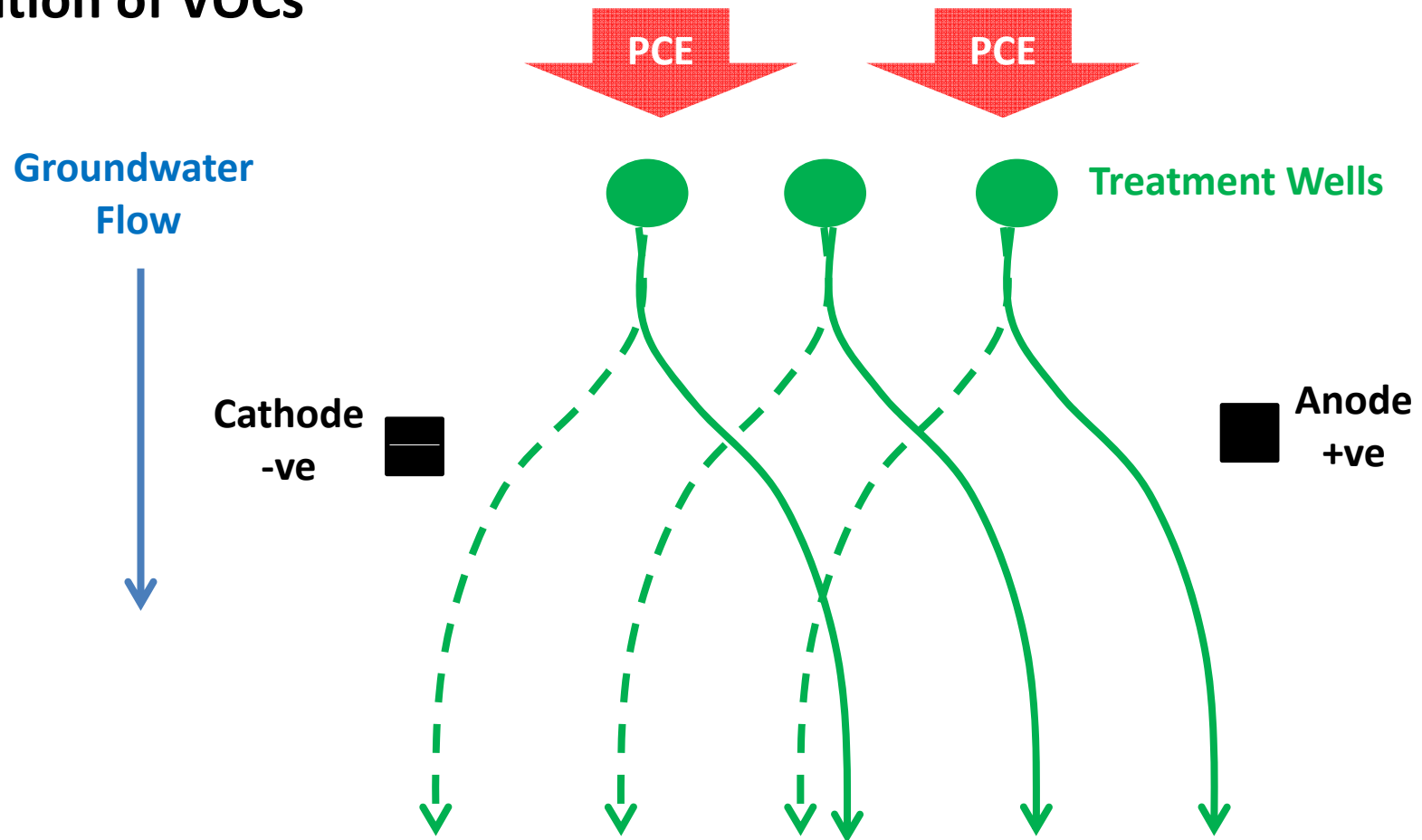


How can EK be applied?

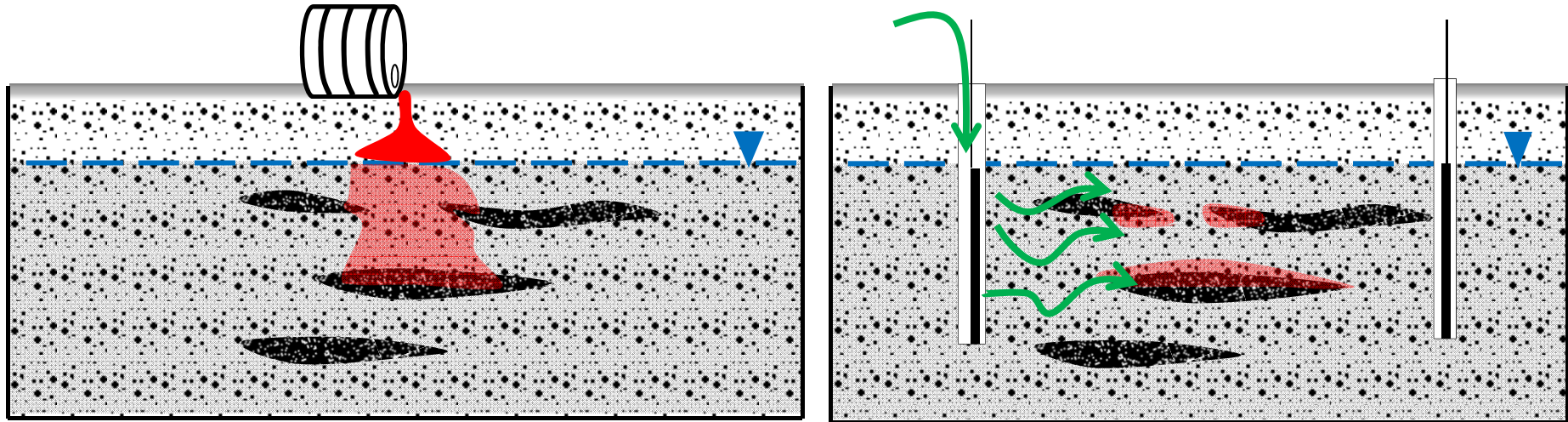


Example of field application

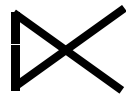
EK Bio-fence Remediation of VOCs



Conceptual Model and Project Premise



Amendment
Electromigration



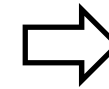
Effective
Ionic
Mobility

Solute
Concentration

Electric
Field

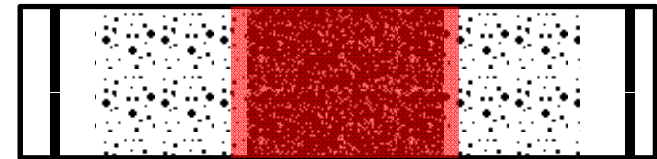
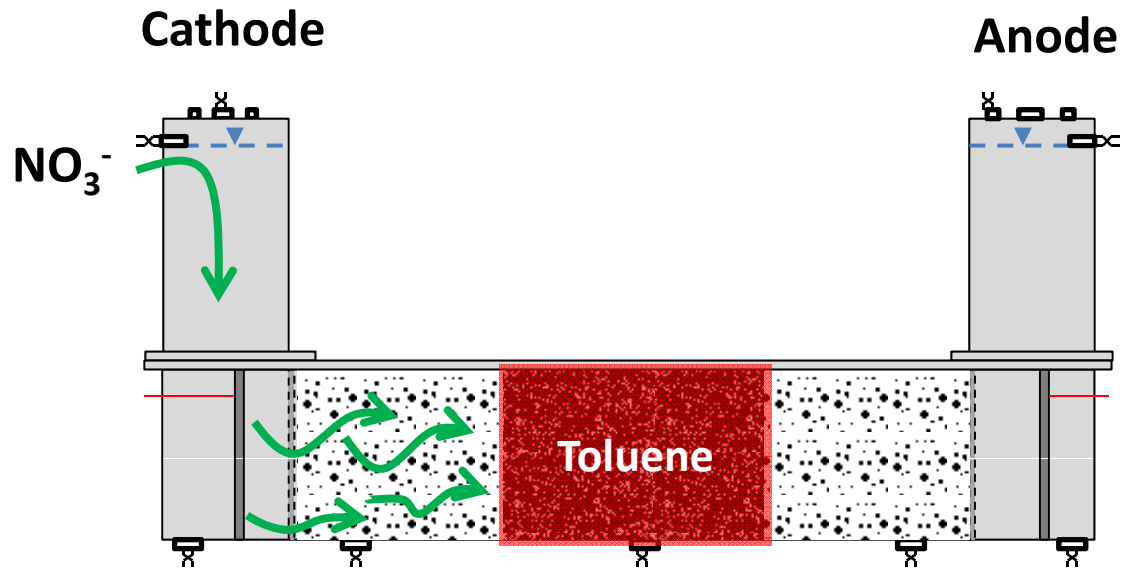
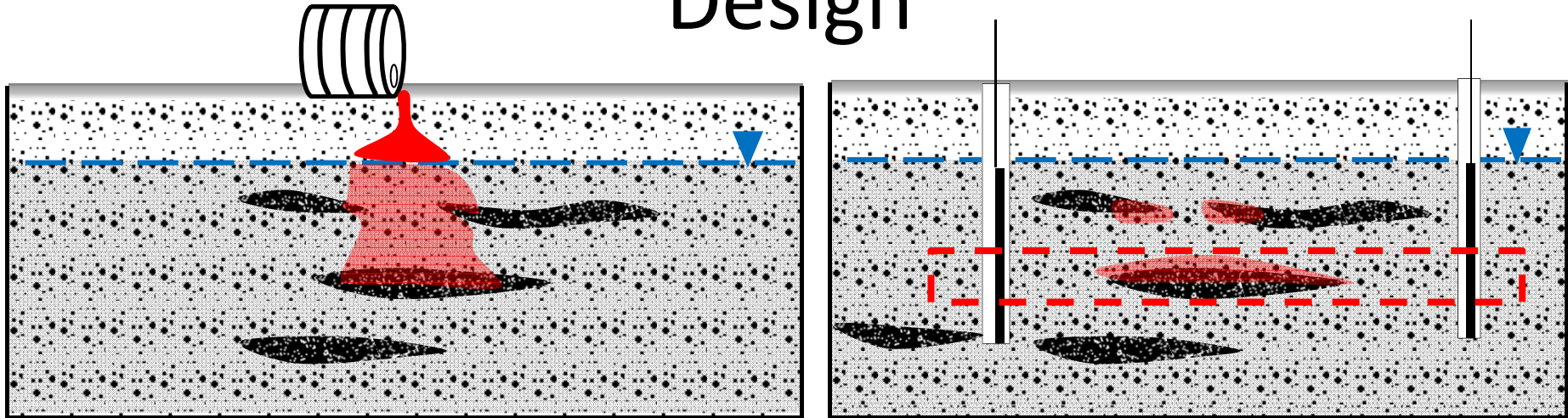
Electroosmotic
Flow

Electrical
Conductivity



Enhanced
Biodegradation

Conceptual Model to Experimental Design



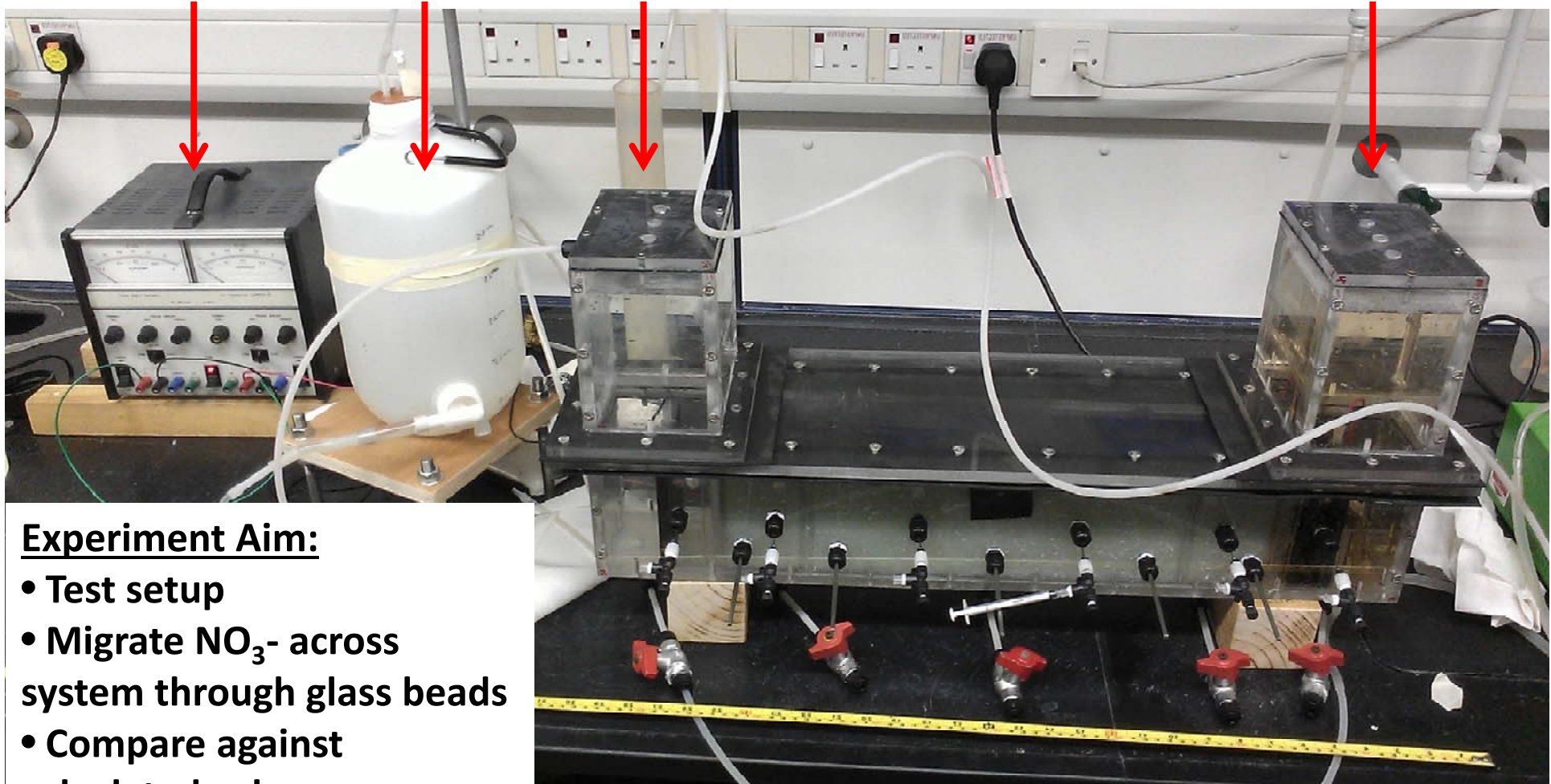
Experimental Setup

Power
Supply

Reservoir
Tank

Cathode

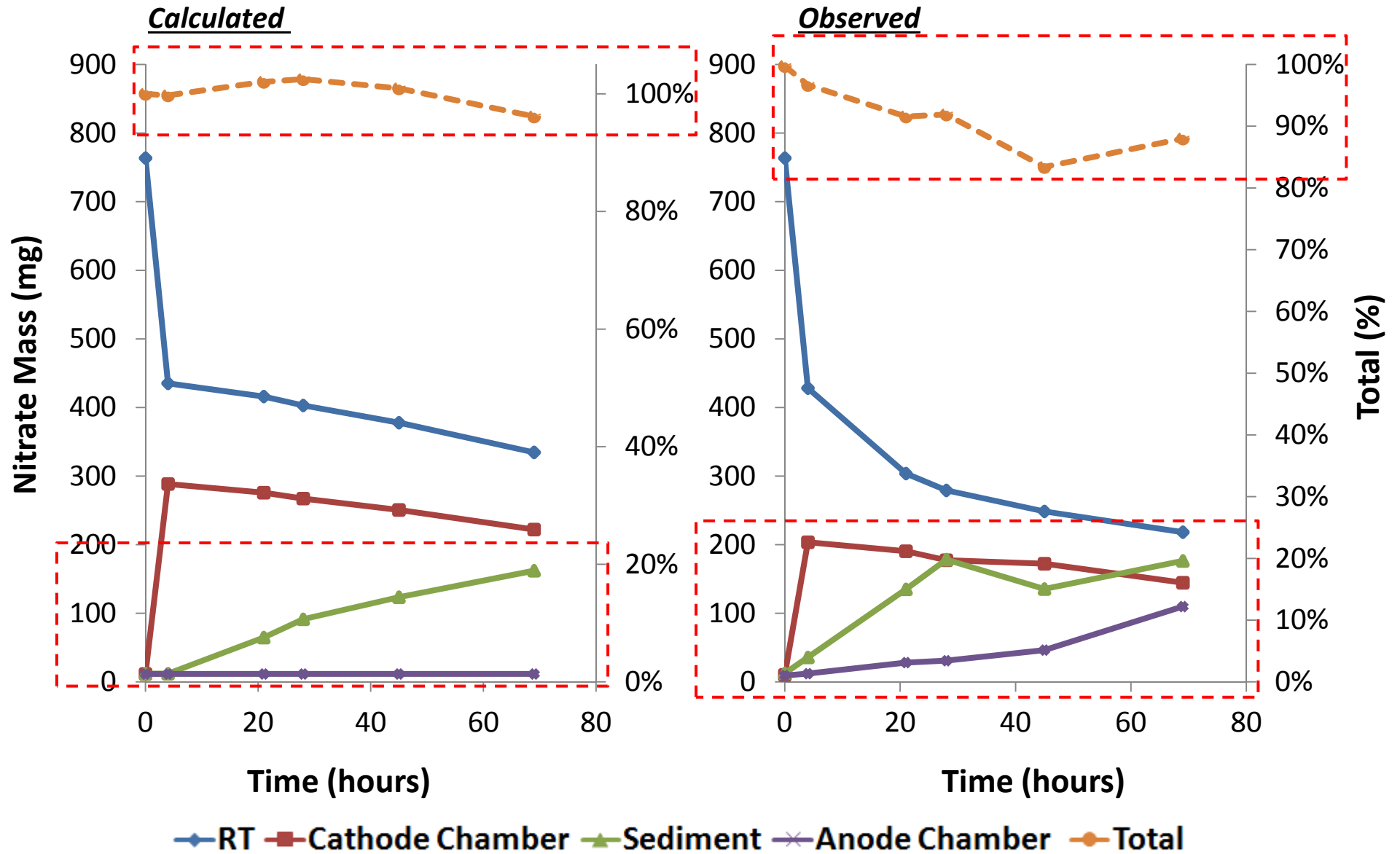
Anode



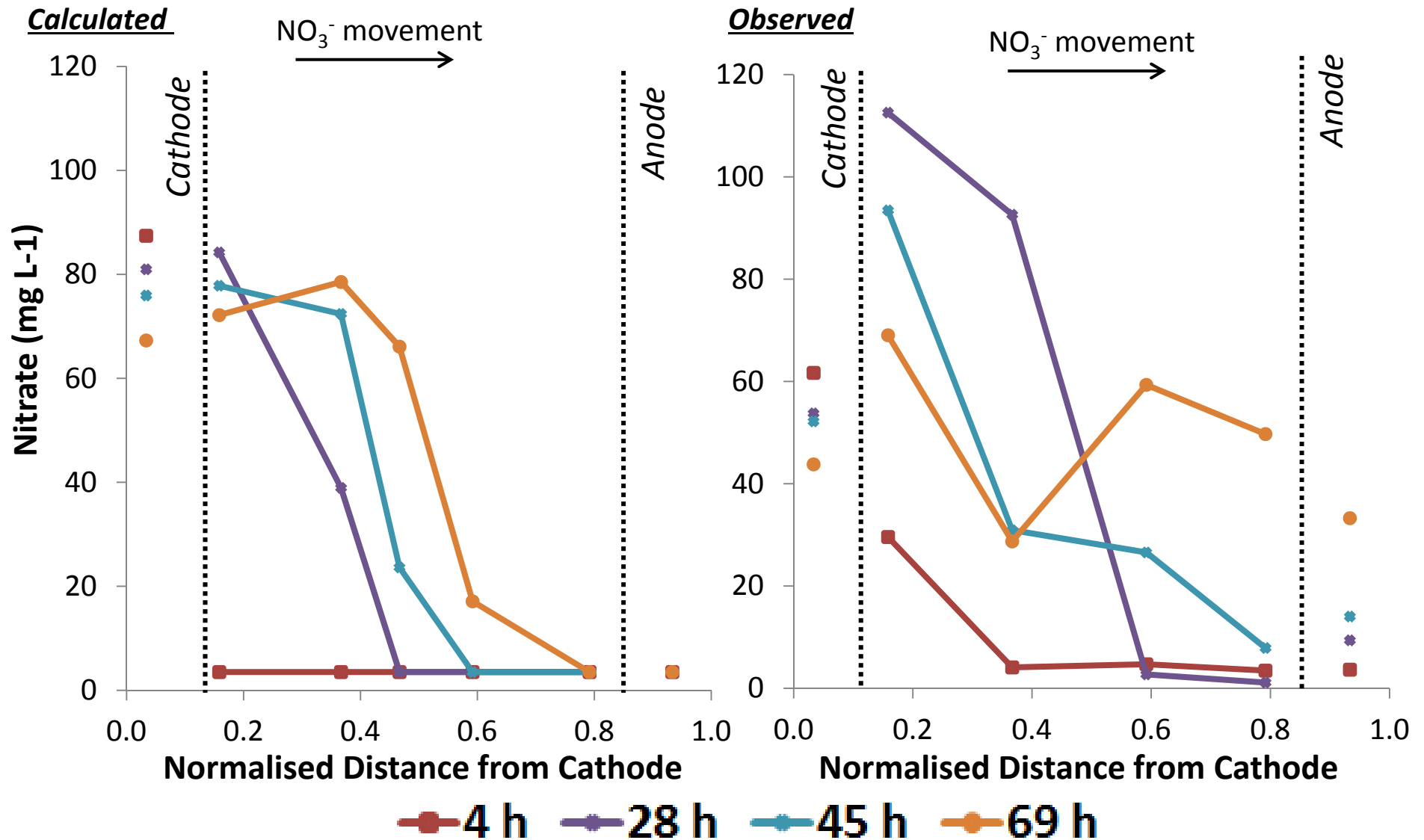
Experiment Aim:

- Test setup
- Migrate NO_3^- across system through glass beads
- Compare against calculated values

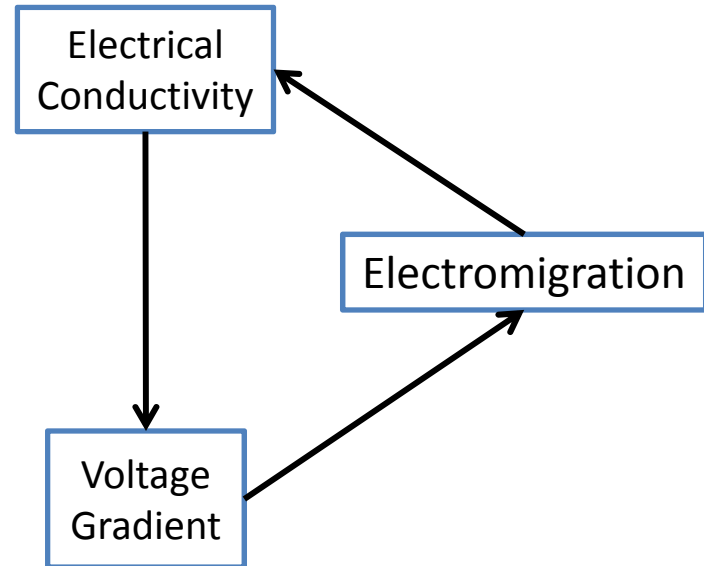
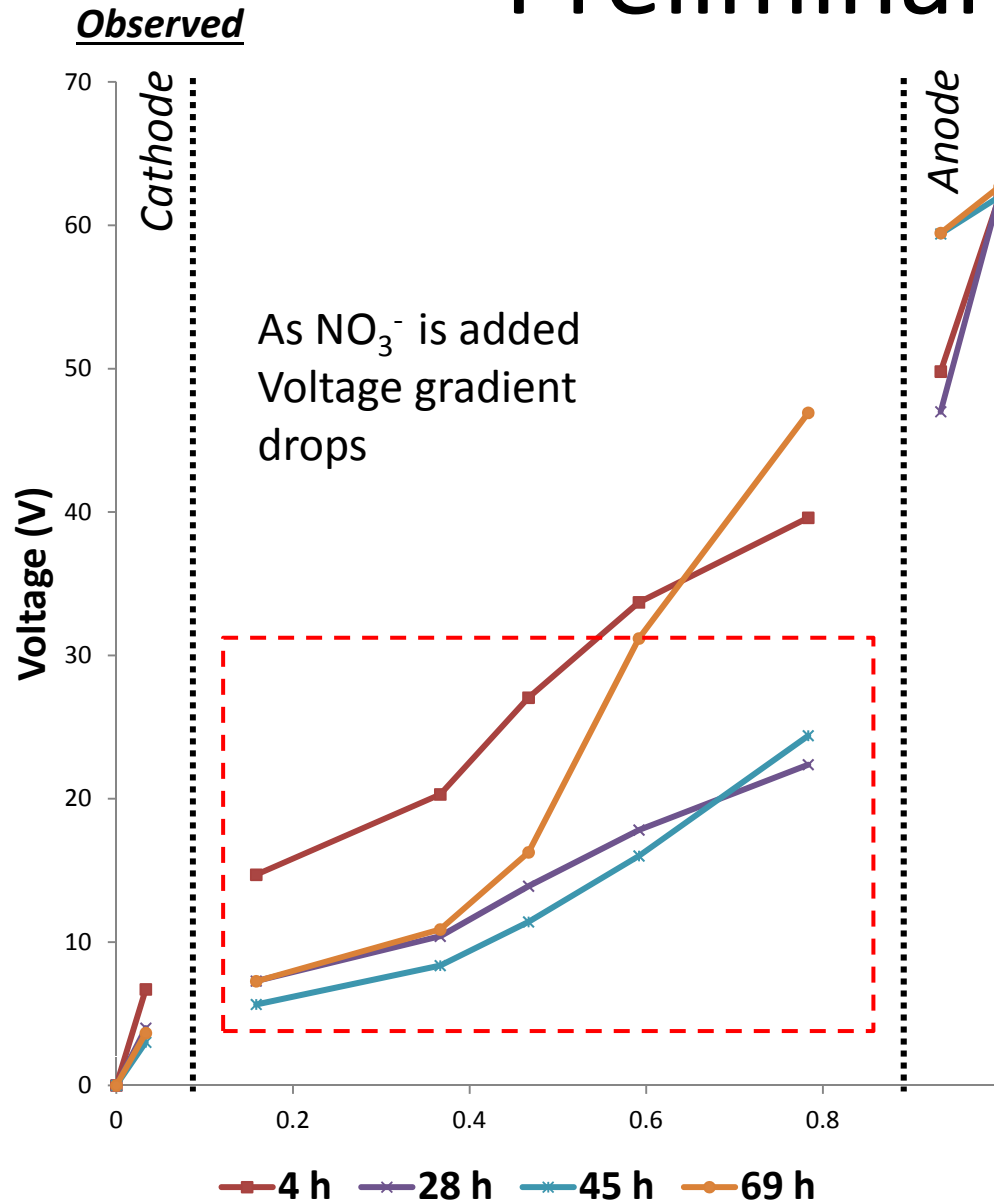
Preliminary Results



Preliminary Results



Preliminary results



Implications

- NO_3^- successfully moved across system
- Multiple factors influencing migration
- Better understanding of lab setup

Conclusions and Future Work

- EK potential to enhance bioremediation
- Application in physically heterogeneous settings require further investigation:

	Details
1	<ul style="list-style-type: none">• Influence of physical heterogeneity represented by spatially variable K on NO_3^- migration• V gradient and NO_3^- concentration on penetration
2	<ul style="list-style-type: none">• Influence of physical heterogeneity on EK-biostimulation• V gradient and NO_3^- concentration on penetration and degradation
3	<ul style="list-style-type: none">• Processes in two-dimensional system• Couple with modelling