Determination of the Cr(VI) Biotransformation Mechanism that Predominates under Sulfate-Reducing Bacterial Activity

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Background

- Hexavalent chrome (Cr6) is a highly toxic and mobile metal that infiltrates groundwater due to improper storage and disposal in related industries.
- Current methods dictate a “physical” decontamination method whereby contaminated soil is removed and treated off site.

Photos courtesy of EPA website.

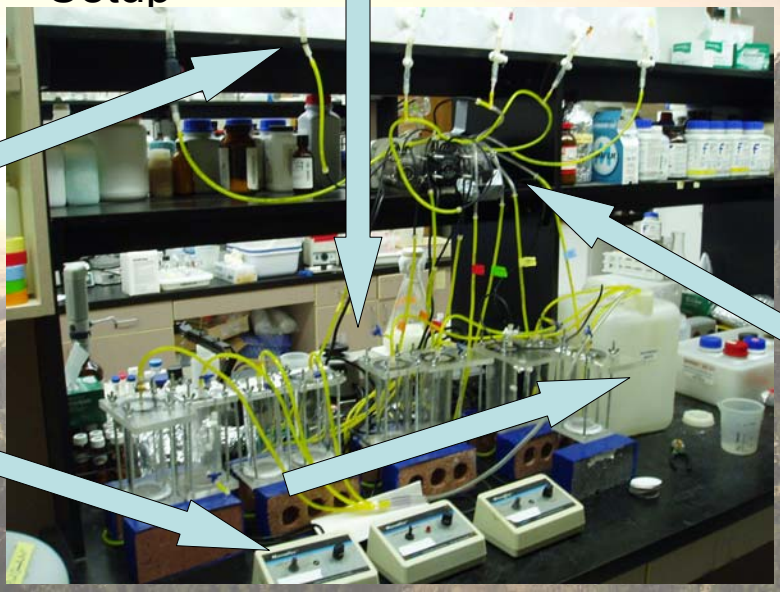
Background

- Bioremediation is a possible alternative to current practices.
- Sulfate Reducing Bacteria- shown to reduce effluent concentrations of Cr6 from soil.
- Implications- possible “in-situ” treatment of contaminated soil.

Experimental Objectives

- Overall: Outline an effective bioremediation strategy to prevent the leaching of Cr6 into groundwater sources.
- My Project: Sulfate Reducing Bacteria: Effective due to byproducts or enzymatic activity?

Experimental Setup



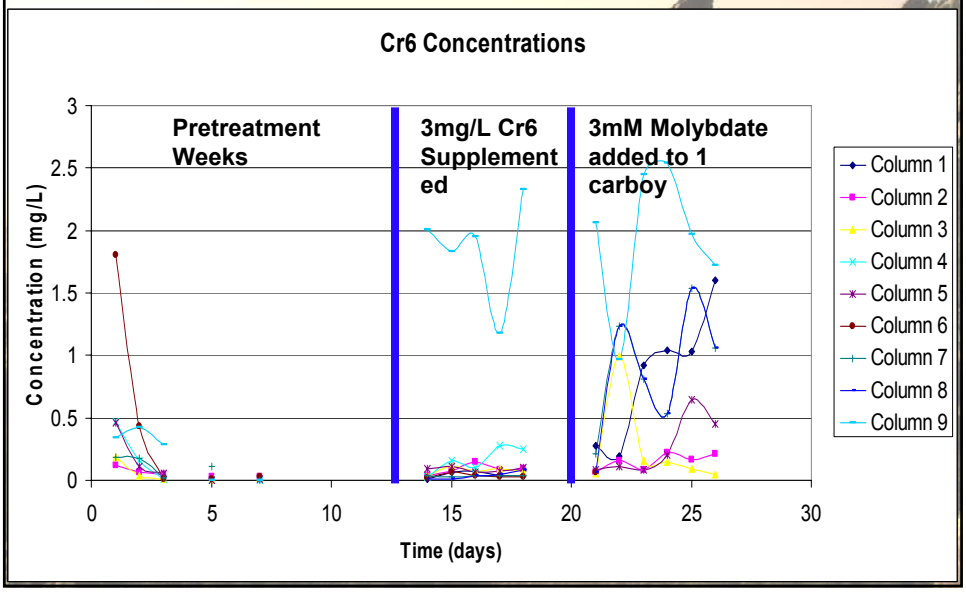
Column Construction

- 150g of burned gravel
- 400g of Cr6 contaminated soil
- 20mL of wastewater sludge
- Flowthrough from bottom to top- approximately 1mL/min
- Influent Variables
  - Groundwater
  - Molasses
    - Molybdate added after 2 wks
  - Sulfide

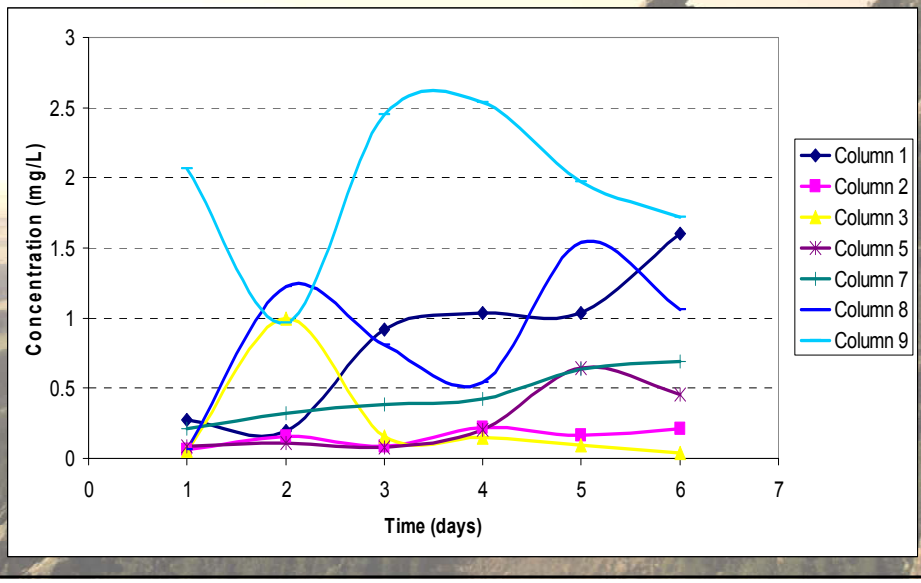
Testing Methods on Liquid Samples

- Diphenylcarbazide for Cr6
  - colorimetric
- Ion-Chromatography for Sulfate content
- TOC Analyzer for total organic carbon
- INT for bioactivity
  - colorimetric

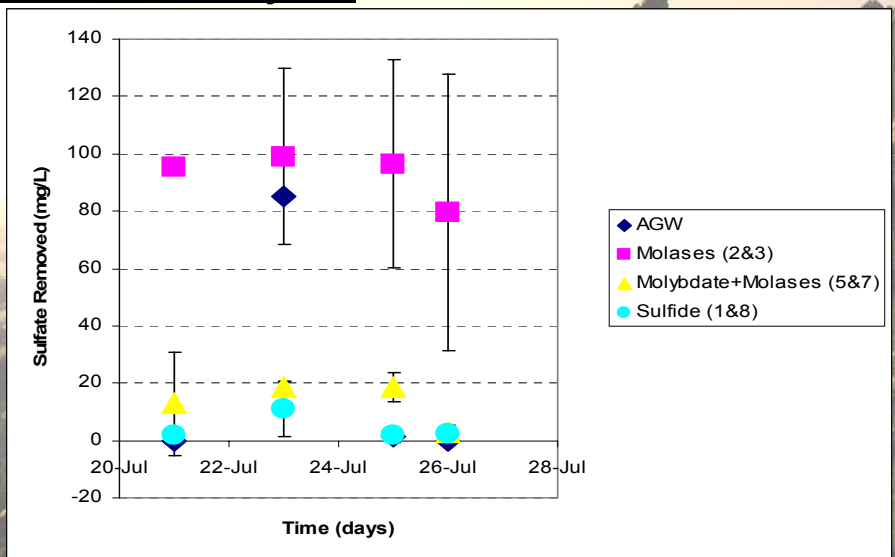
Cr6 Data



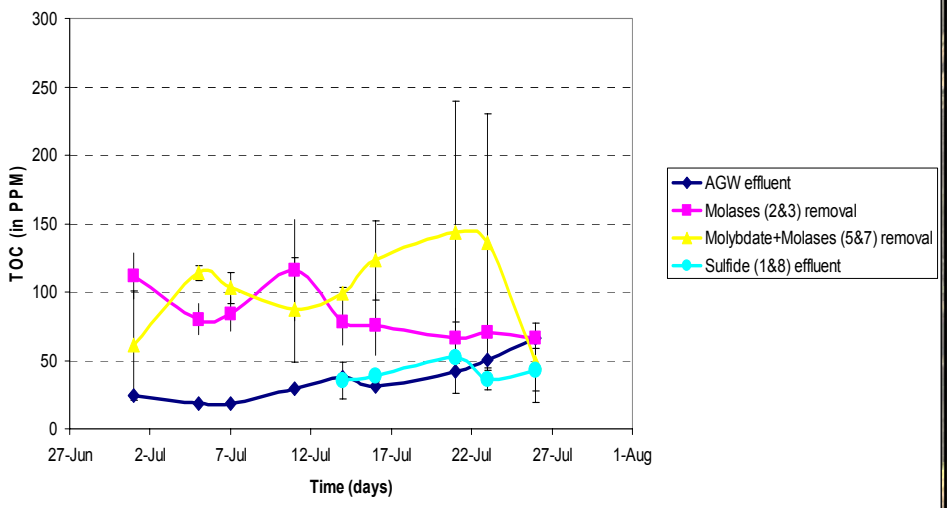
Cr6 Data



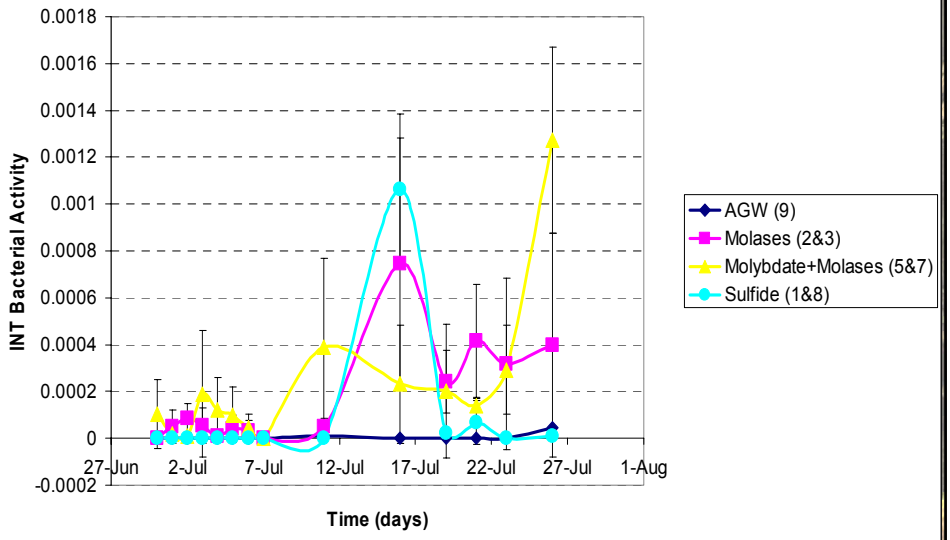
Sulfate Analysis



Total Organic Carbon



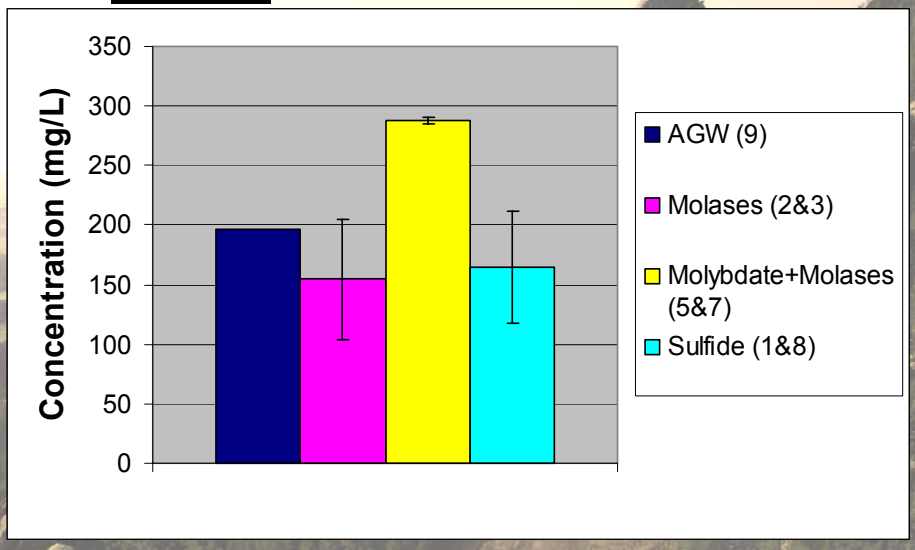
INT (bacteria in effluent water)



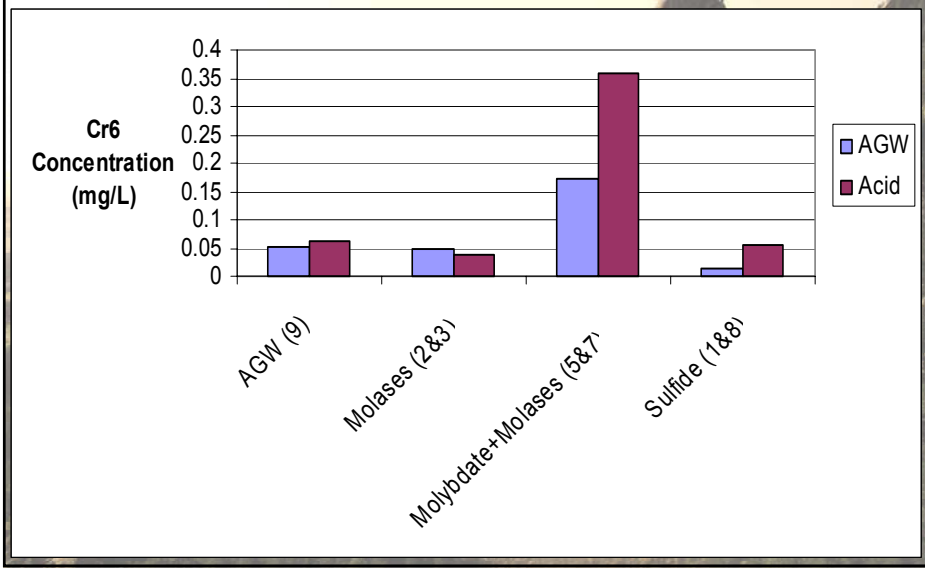
Final Methods

- Acid digestion
- Equilibrium
- Volatile Solids

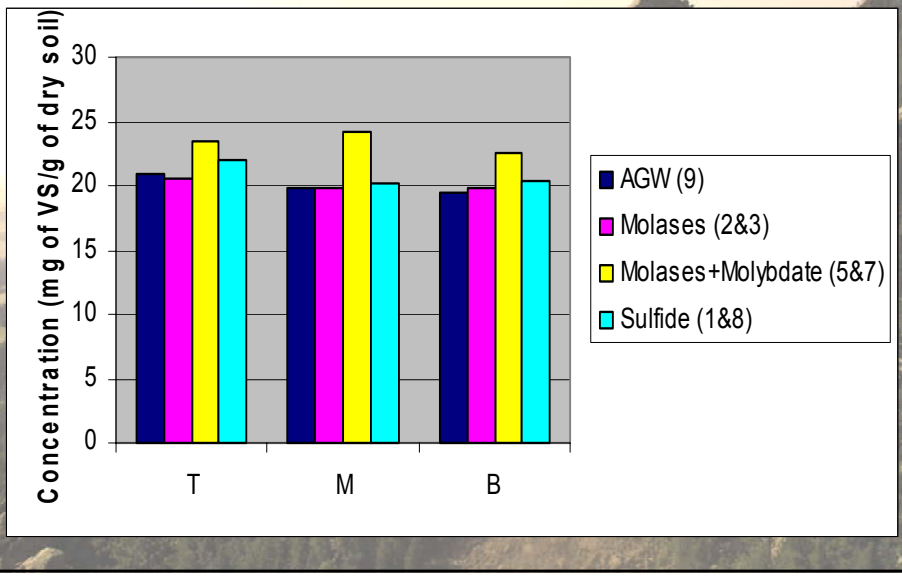
Acid Digestion Results



Equilibrium



Volatile Solids



Conclusions

- Successful cultures of sulfate reducing bacteria
- High concentrations of Cr6 in soil; low effluent concentrations
- Molybdate successfully inhibited SRB activity

Work to Be Done

- Data Analysis
- Research and testing on correction methods
- Characterization of sulfate reducing bacteria

Questions?