Background and Objectives

- In-situ bioremediation methods cause high amounts of microbial growth near substrate injection points, which leads to bioclogging.
- Bioclogging in soil pores reduces permeability and artificial recharge in the subsurface.
- Microbial inhibitors, such as acetylene, may be used to control bioclogging where aerobic cometabolic processes are occurring.
- The objective of this research is to determine the effect of acetylene on biomass production in TCE cometabolizing cultures.
- Additionally, we sought to verify if our culture could degrade 1,4-Dioxane, a common co-contaminant at TCE contaminated sites.

Methodology

Acetylene Inhibition of TCE Aerobic Cometabolism:
- Two propane-fed microbial cultures used
  - Mycobacterium austroafricanum JOB5
  - Soil-derived propane-oxidizing mixed culture
- Cultures exposed to acetylene gas (5% v/v in headspace) for different lengths of time
  - 0, 1, 2, 4, and 8 days

1,4-Dioxane Degradation Experiment:
- Soil-derived propane-oxidizing mixed culture

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Propane (mM)</th>
<th>Oxygen (µM)</th>
<th>1,4-Dioxane (µM)</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>53.5</td>
<td>5000</td>
<td>Verify if culture will degrade metabolically</td>
</tr>
<tr>
<td>B</td>
<td>13.4</td>
<td>13.4</td>
<td>50</td>
<td>Verify if culture will degrade cometabolically</td>
</tr>
<tr>
<td>C</td>
<td>13.4</td>
<td>13.4</td>
<td>50</td>
<td>Oxygen and propane consumption control</td>
</tr>
<tr>
<td>D</td>
<td>13.4</td>
<td>13.4</td>
<td>50</td>
<td>Abiotic control</td>
</tr>
</tbody>
</table>

Key Findings

Acetylene Inhibition of TCE cometabolism
- With an increase in the exposure time of acetylene the following decrease:
  - Biomass production rates-Optical Density and Protein Data
  - Propane and Oxygen consumption rates
  - TCE degradation rates

1,4 Dioxane Degradation Experiment
- Degradation rate of 1,4-dioxane concentrations for Treatment A (metabolism):
  - 12.57 µM/day
- Degradation rate of 1,4-dioxane concentrations for Treatment B (cometabolism):
  - 1.85 µM/day