PTAC Environmental R&D Forum

Groundwater, Natural Wetlands and Attenuation Session

Solar Detoxification

Application of Lignin in Remediation

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Solar Detoxification - Remediation of Groundwater Contaminated with Organics

R&D Performed by: SAIC Canada

Financial Support by: City of Ottawa, PERD, Environment Canada and Natural Resources Canada

Technical Support by: Natural Resources Canada

Solar Detoxification - Solaqua Process
(Bolton, Cater, Safarzadeh)

- Uses ferrioxalate as a photochemical agent
- Ferrioxalate absorbs UV and visible light up to 500 nm
- Ferrioxalate is complex of iron(III) and oxalic acid

- Photolysis of ferrioxalate generates iron(II)
- Iron(II) reacts with peroxide to generate hydroxyl radical
- Hydroxyl radical breaks down organic contaminants

Objective:

- Continue development of solar detoxification process for the treatment of Contaminated Groundwater

Scope:

- Contaminant Selection and Bench-scale testing
- Process Model Development and Performance Prediction

Current Phase Cost: $77,500

Researchers: Dr. Shamil Cathum / Dr. Kostantin Volchek
Dario Velicogna / Alison Obenauf / Louise Robichaud
Dr. Stephen Cater
Bill Wong

Deliverables:

- Report documenting treatment process model and test results

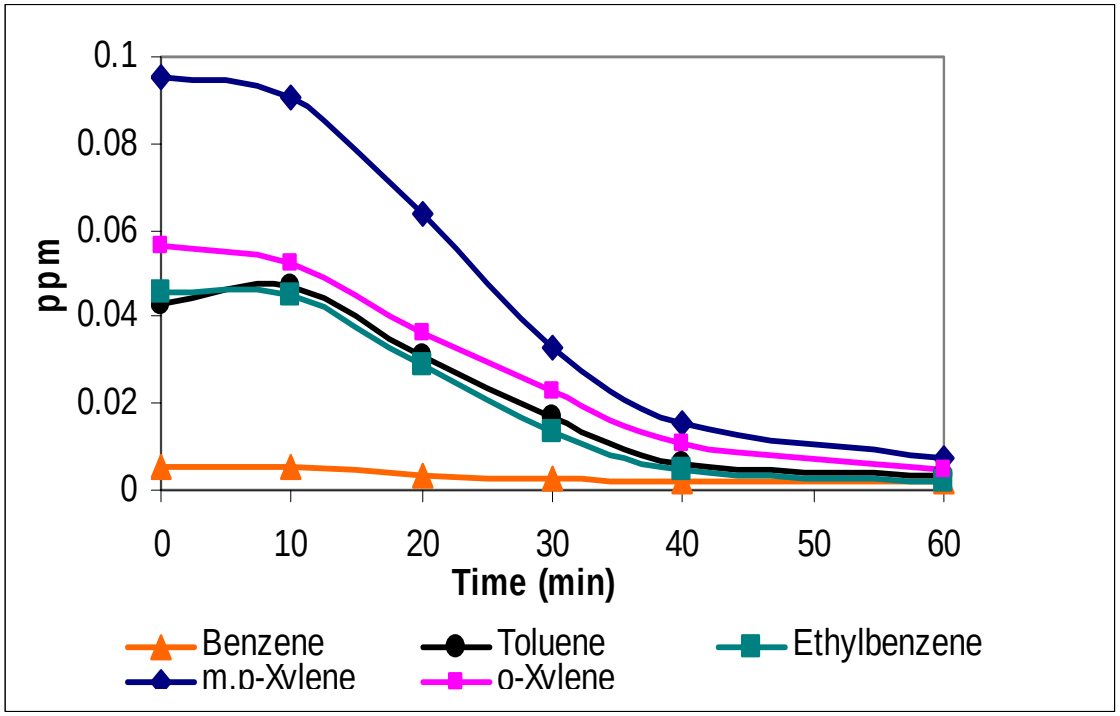
Results to date:

- Demonstrated BTEX and MTBE destruction
- Developed bench-scale model on process performance

Trail Road Landfill Site (Ottawa, Ontario)

Landfill Leachate Treatment

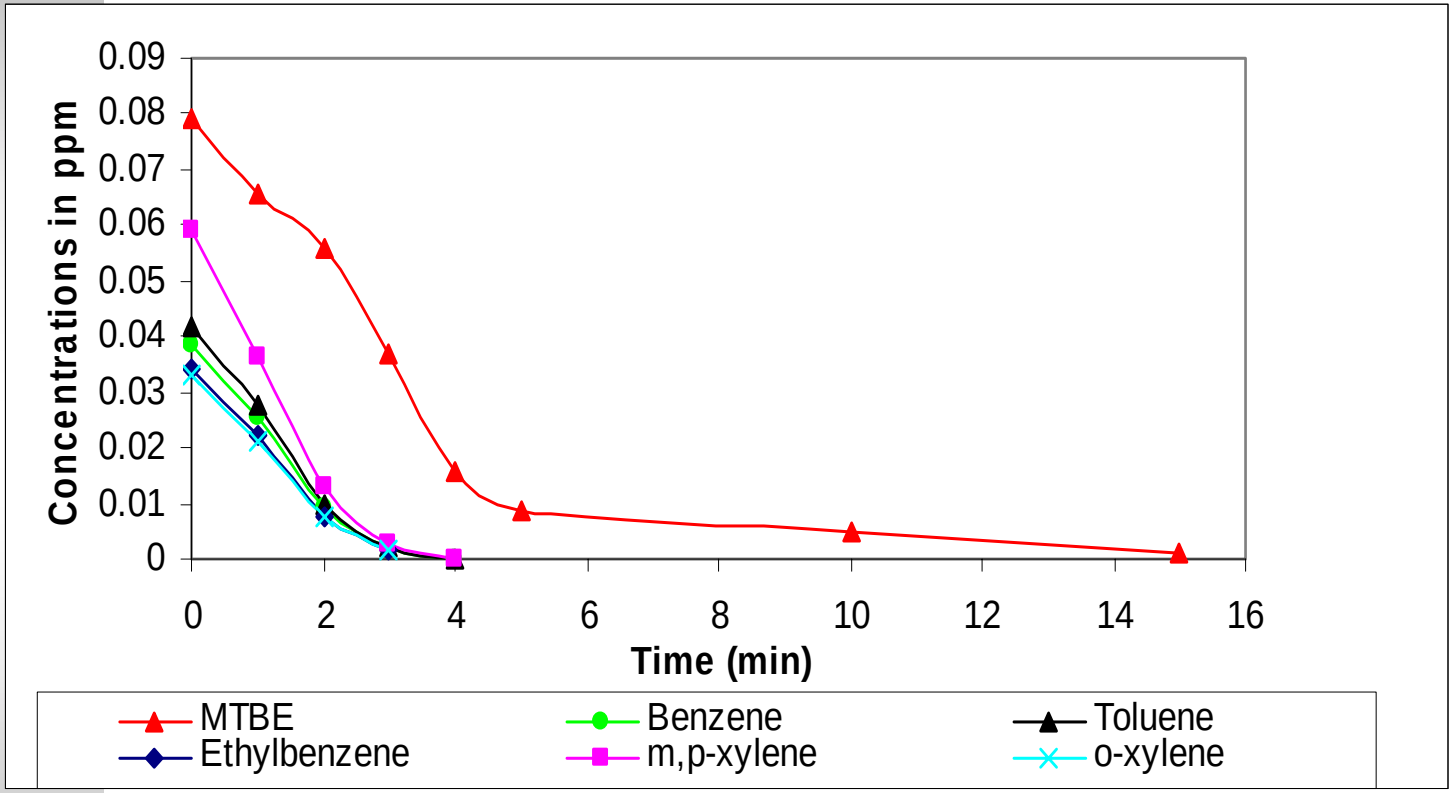
BTEX concentration vs. exposure time



Field Test – circulation through solar panels

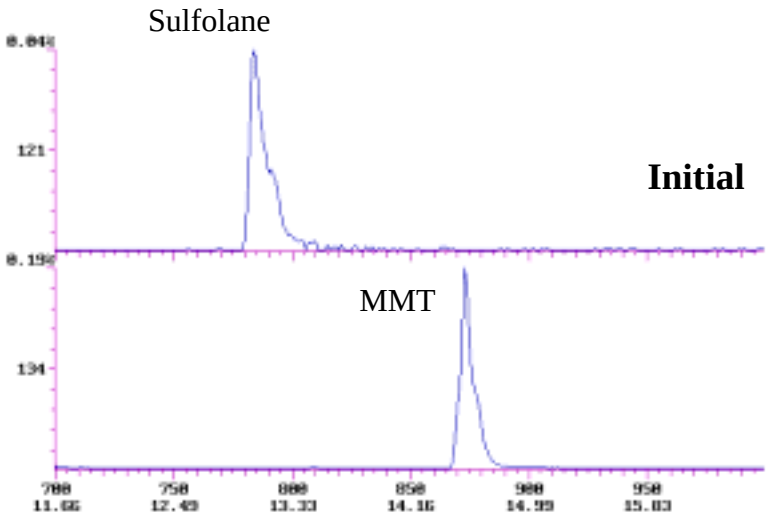
Spiked Water Treatment

BTEX and MTBE concentration vs. exposure time



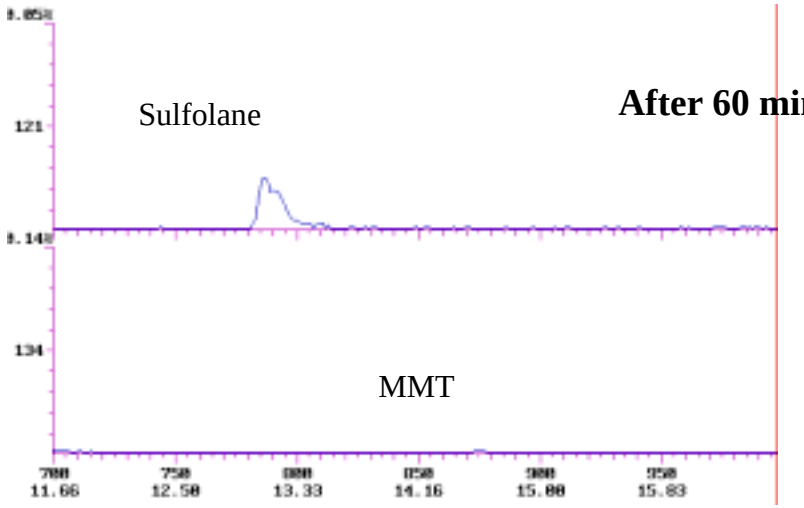
Bench-scale Test – circulation through lamp reactor

Spiked Water Treatment
Sulfolane and MMT
(GC/MS Analysis)



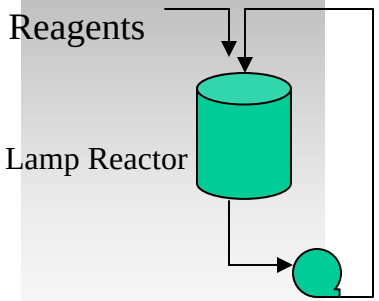
Initial

Bench-scale Test
– circulation through
lamp reactor



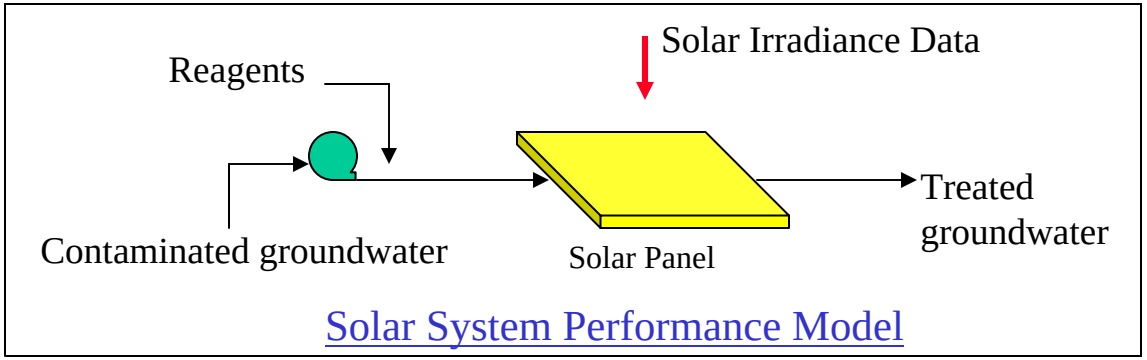
After 60 minutes

Solar Detoxification Model Development



Bench-scale Equipment
with artificial photon source
treating contaminated water

Pollutant destruction model
(fluid characteristics, pollutants, process parameters)



System Design and Performance Prediction

Implications for Industry and Regulators:

- Renewable energy based technology for contaminant destruction

Future Work:

- Field scale technology demonstration and performance model validation
- Summer/Fall of 2002
- Require Industry Partner

Other environmental applications:

- Treatment of industrial wastewater

Remediation of Mixed-Contaminated Soil Using Lignin Derivatives

R&D Performed by: SAIC Canada

Financial Support by: PERD and Environment Canada

Technical Support by: Cellutech LLD.

Environment Canada Environnement Canada

Natural Resources Canada Ressources naturelles Canada

Environment Canada Environnement Canada

Natural Resources Canada Ressources naturelles Canada

Remediation of Mixed-Contaminated Soil Using Lignin Derivatives

Lignin:

- By-product of pulp and paper industry
- Inexpensive and readily available
- Non-toxic
- Can be converted into water soluble active compounds

Useful features of lignin derivatives:

- Bind heavy metal ions
- Solubilize petroleum hydrocarbons

Idea:

Use lignin derivatives as additives to achieve simultaneous removal of metals and organic contaminants in in-situ soil flushing

Objective:

Develop in-situ soil flushing process for the simultaneous removal of organic contaminants and heavy metals.

Cost: $74,000

Lead Researcher:

Dr. Konstantin Volchek
Andrew Somers / Louise Robichaud
Bill Wong

Scope:

- Polymer selection,
- Bench-scale testing, including
  - aqueous solution tests
  - column leaching
  - slurry leaching
  - electrokinetic treatment (for clayey soil)
  - wastewater treatment
- Process optimization
- Recommendations for pilot-scale tests

Deliverables:

- report documenting treatment process and bench-scale results

Results to date:

- improved removal of heavy metals
- dissolution and removal of petroleum products

Contaminant	Percentage removal	
	"conventional"process	with lignin derivatives
Hg	0%	15%
U	0%	42%
Cd	26%	70%
Cr	0%	24%
Pb	29%	75%
TPH	0%	35%

Implications for Industry and Regulators:

- Inexpensive means to treat mixed contaminants using non-toxic, natural polymers.

Future Work:

- Field scale technology demonstration
- Summer / Fall of 2002
- Require Industry Partner

Other environmental applications:

- remediation of groundwater
- promoters of phytoremediation