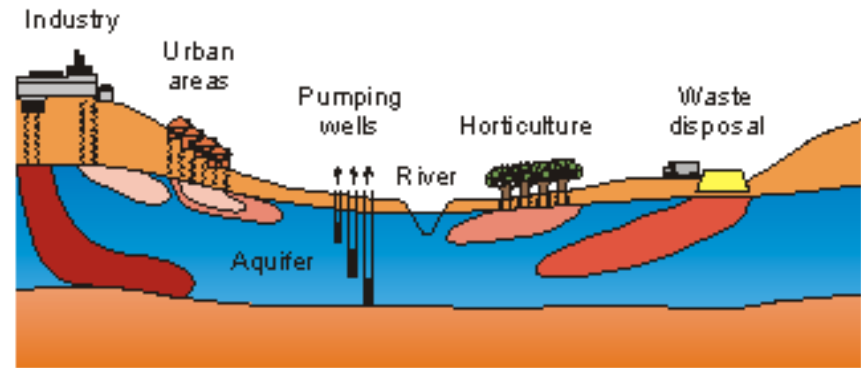
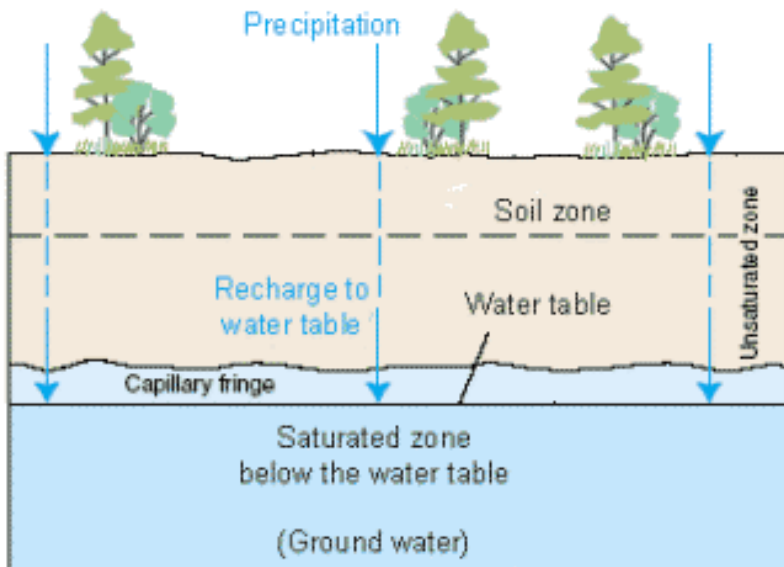


Usage of Water-Filled Trench in Improving Groundwater Quality

Gang Chen, Amy Chan Hilton, and Kamal Tawfiq

**Department of Civil and Environmental Engineering
FAMU-FSU College of Engineering**



- Industrial pollutants
- Organic pollutants, ammonia, chloride
- Nutrients, pesticides, herbicides
- Oil products

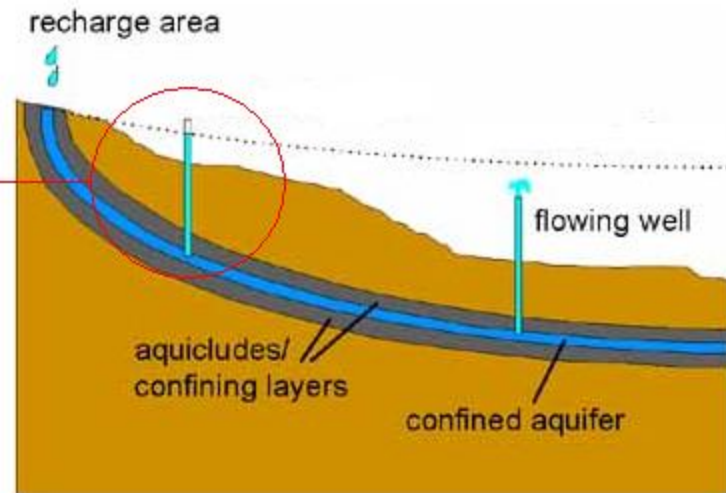
Shallow Vadose Zone

BTEX, PCE, TCE and Iron Contamination

Groundwater in Florida



- Organic compound degradation
- Volatile organic compound vaporization
- Metal oxidation and precipitation

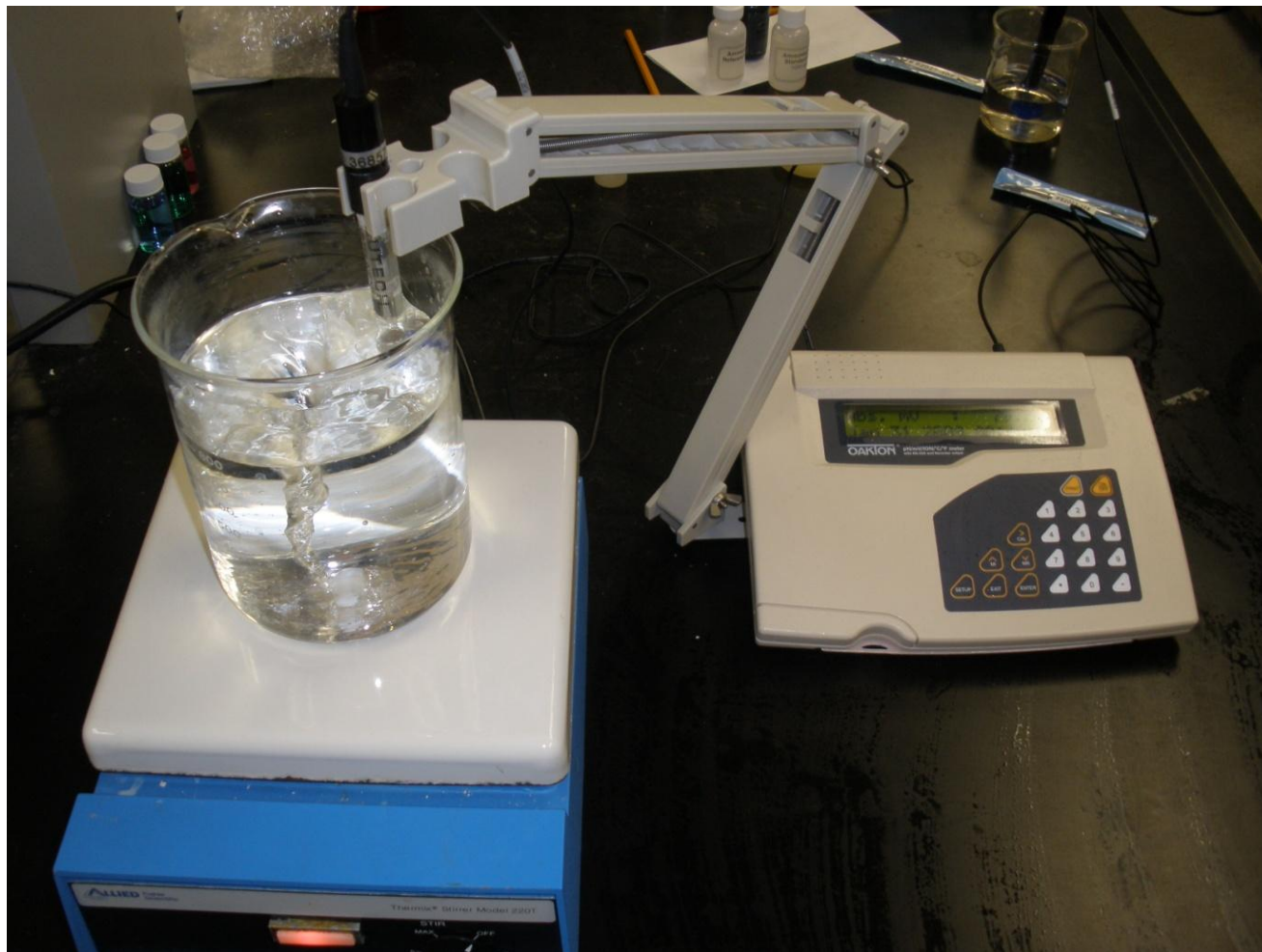


Water-Filled Trench

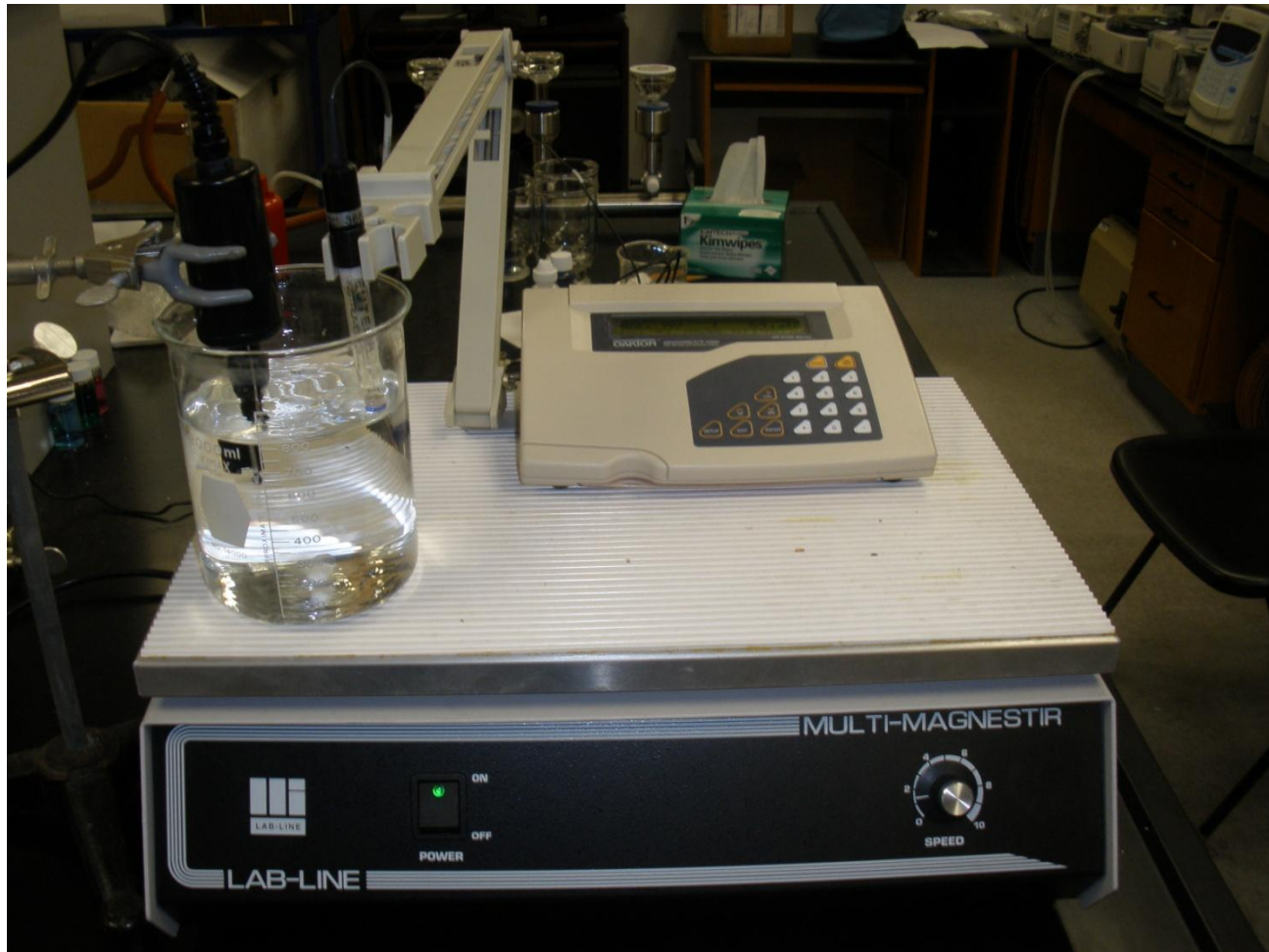
Objectives

- **Explore the possibility of the usage of water-filled trench in treating contaminated groundwater**
- **Identify dominating mechanisms**
 - Organic decomposition
 - Volatile organic compound vaporization
 - Metal oxidation and precipitation
- **Ferrous Iron Release and Adsorption**
 - Effect of pH

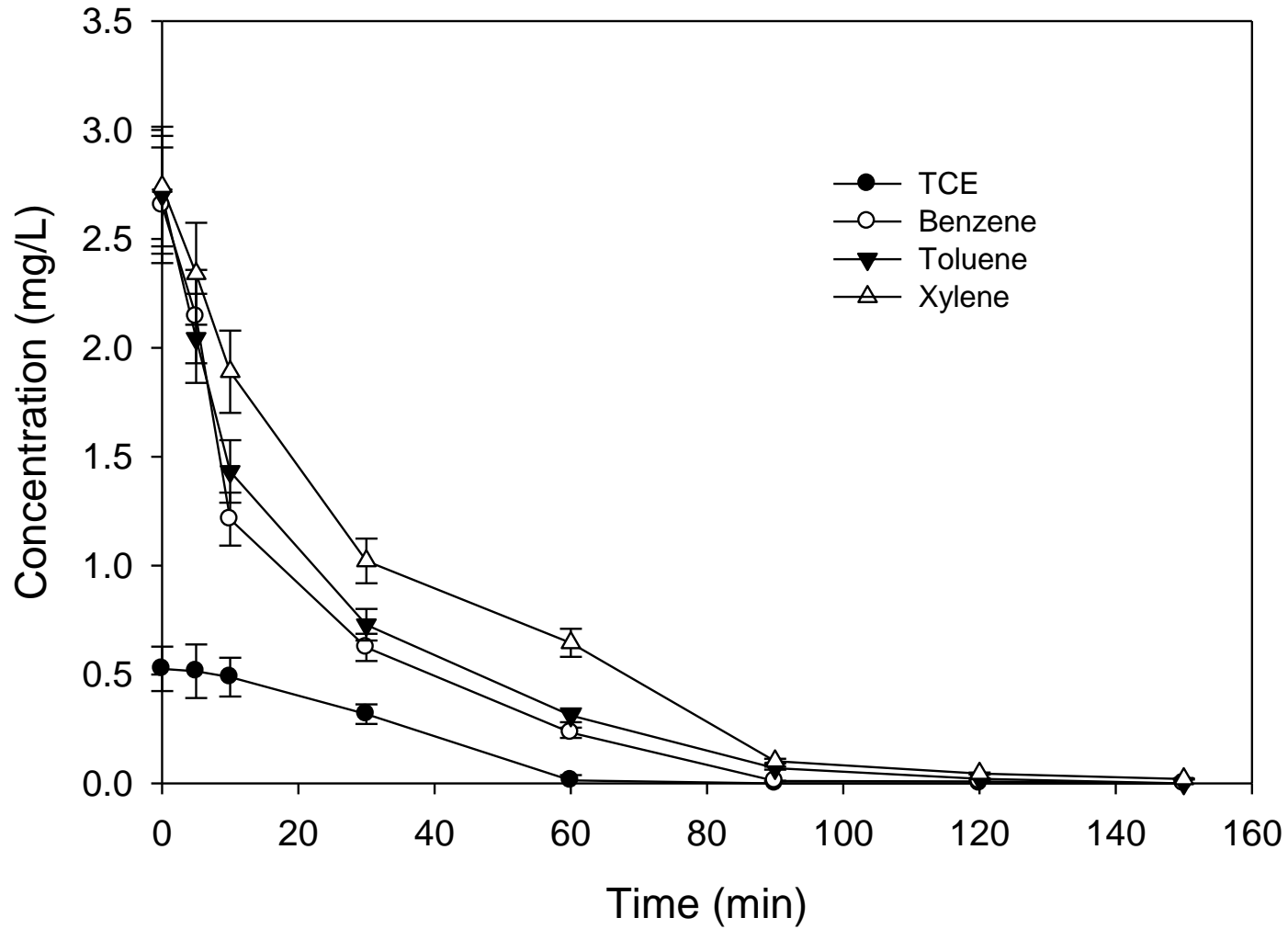
Evaporation



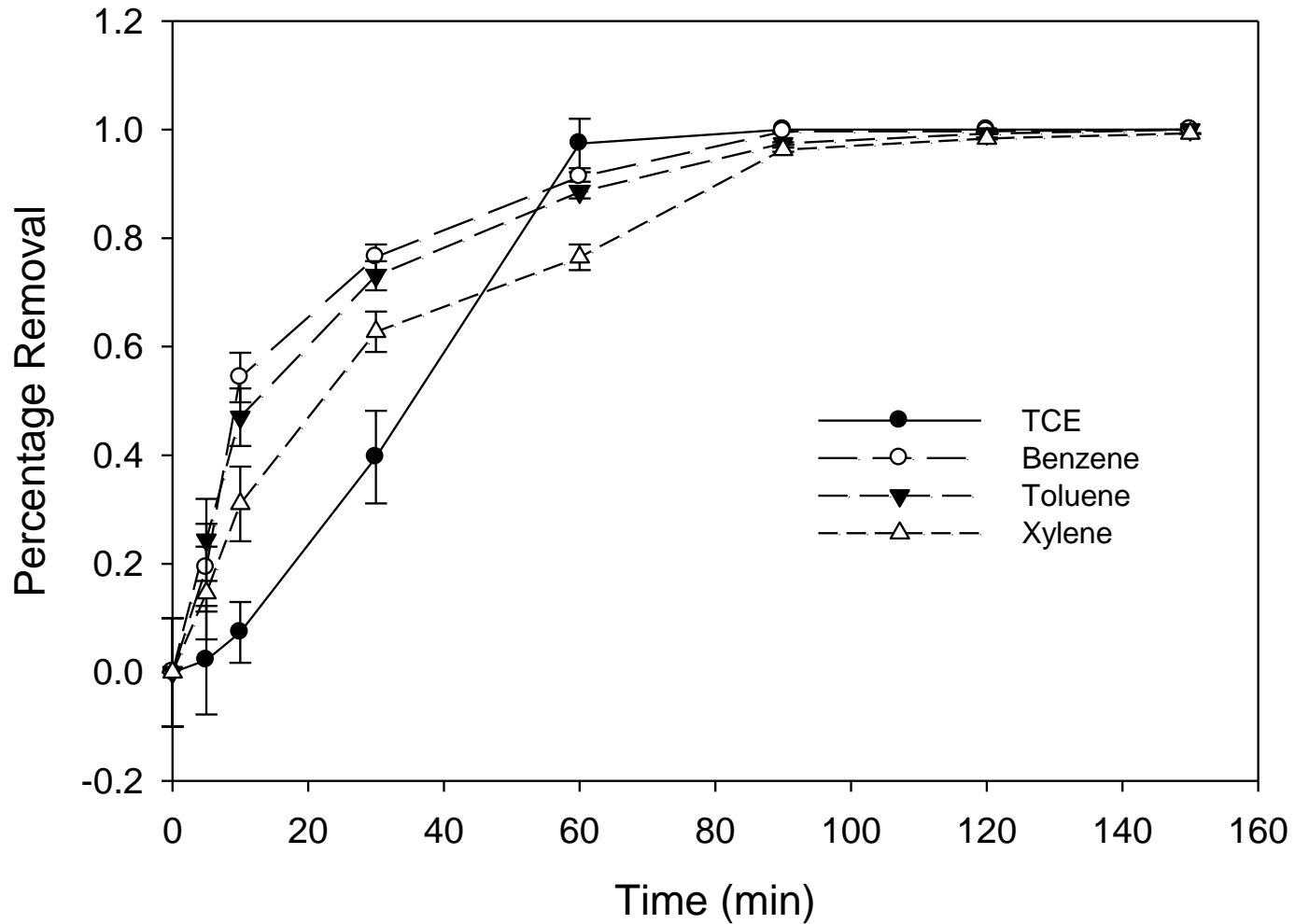
Evaporation



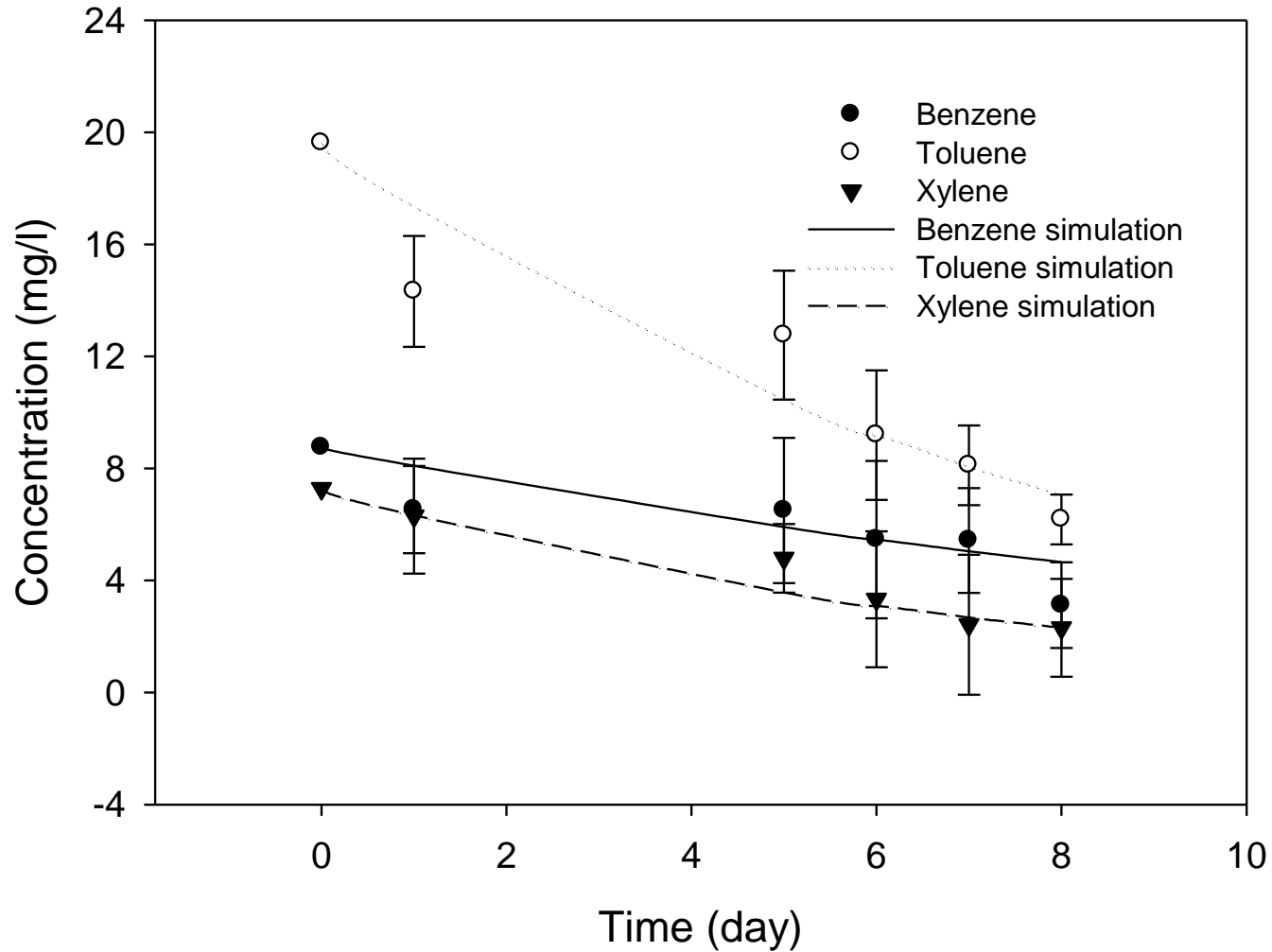
Removal through Evaporation



Removal through Evaporation



Removal through Biodegradation



Removal through Biodegradation

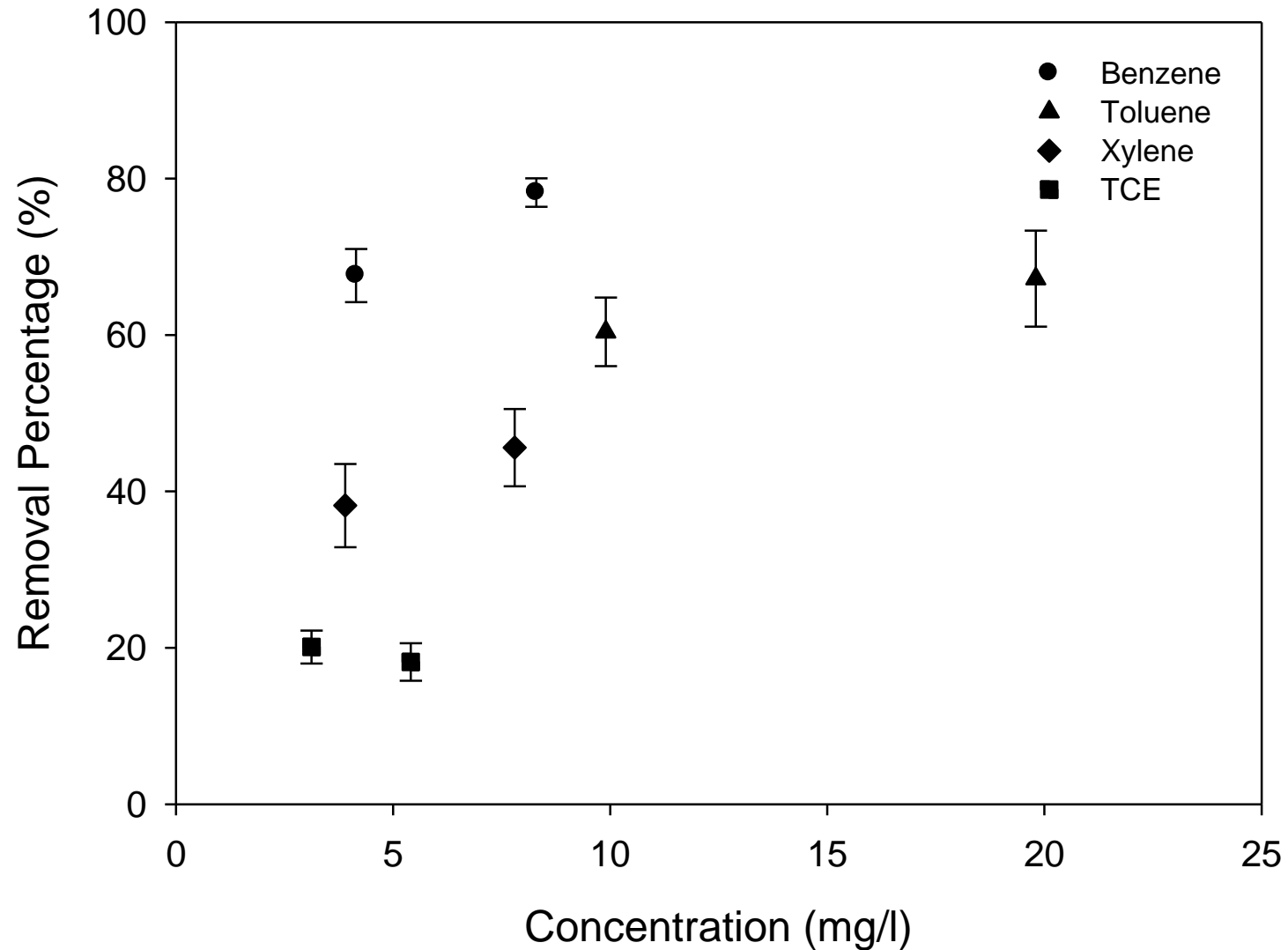
$$\frac{dX}{dt} = \frac{\mu_m [S_0 - \frac{1}{Y} (X - X_0)] X}{K_s + [S_0 - \frac{1}{Y} (X - X_0)]} - \frac{bX}{K_s + [S_0 - \frac{1}{Y} (X - X_0)]}$$

| | K_s (mg/l) | Y (g biomass per g substrate) | μ_{max} (hr ⁻¹) |
|---------|-----------------|-------------------------------------|------------------------------------|
| Benzene | 203.6 | 0.0758 | 0.00837 |
| Toluene | 174.4 | 0.0673 | 0.0107 |
| Xylene | 169.8 | 0.0663 | 0.0110 |

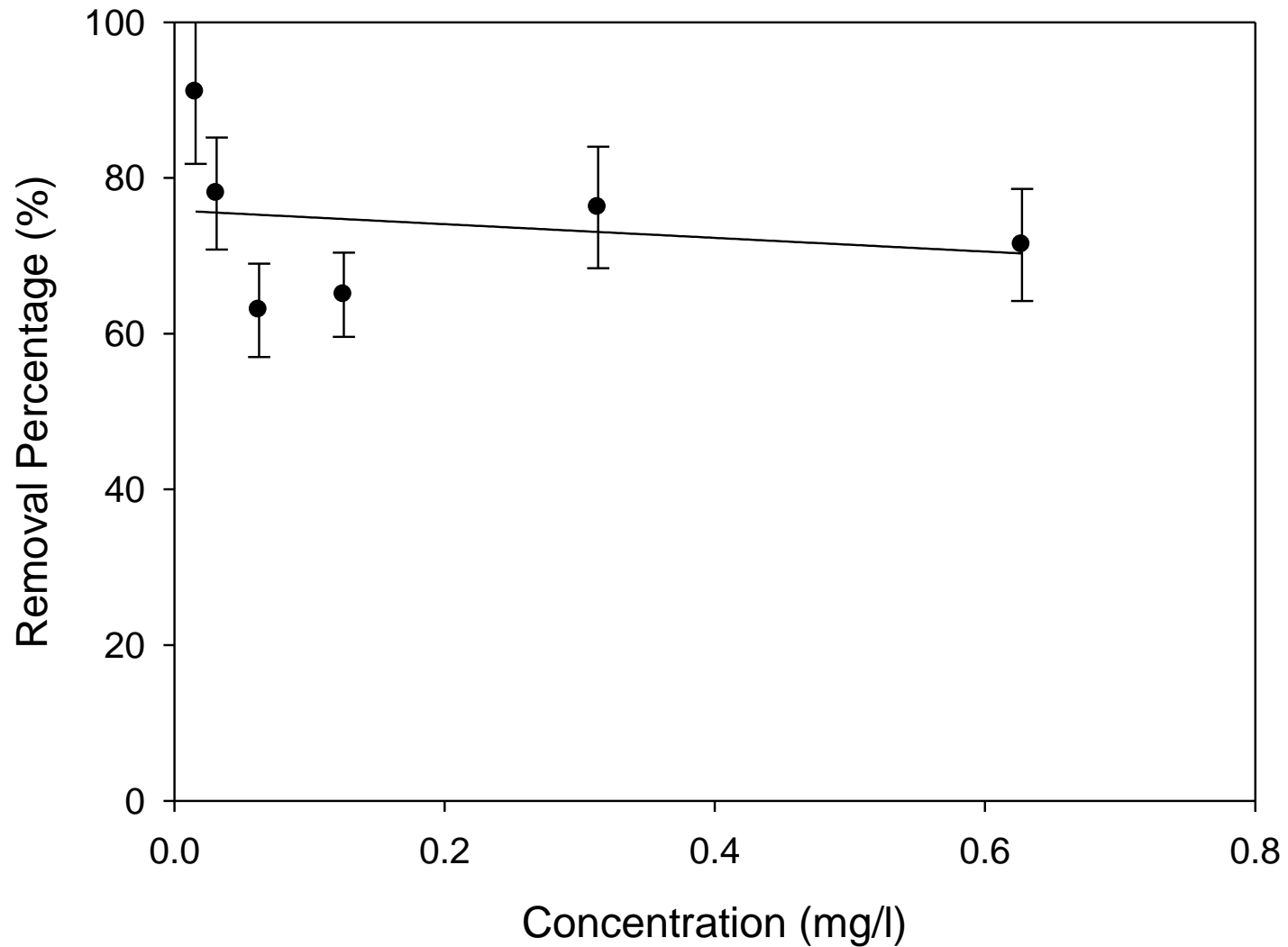
Removal through Filtration



Removal through Filtration (BTEX)

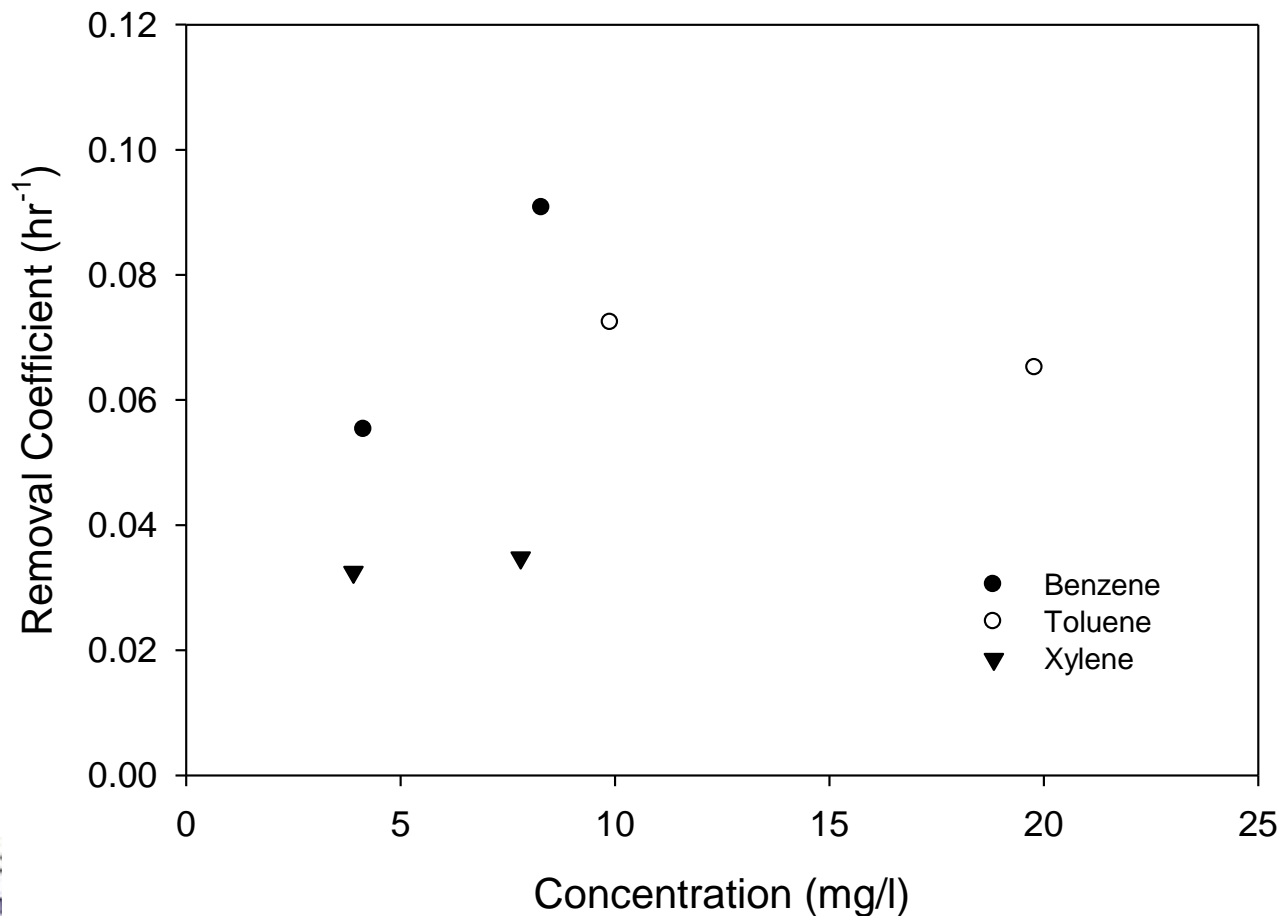


Removal through Filtration (Iron)



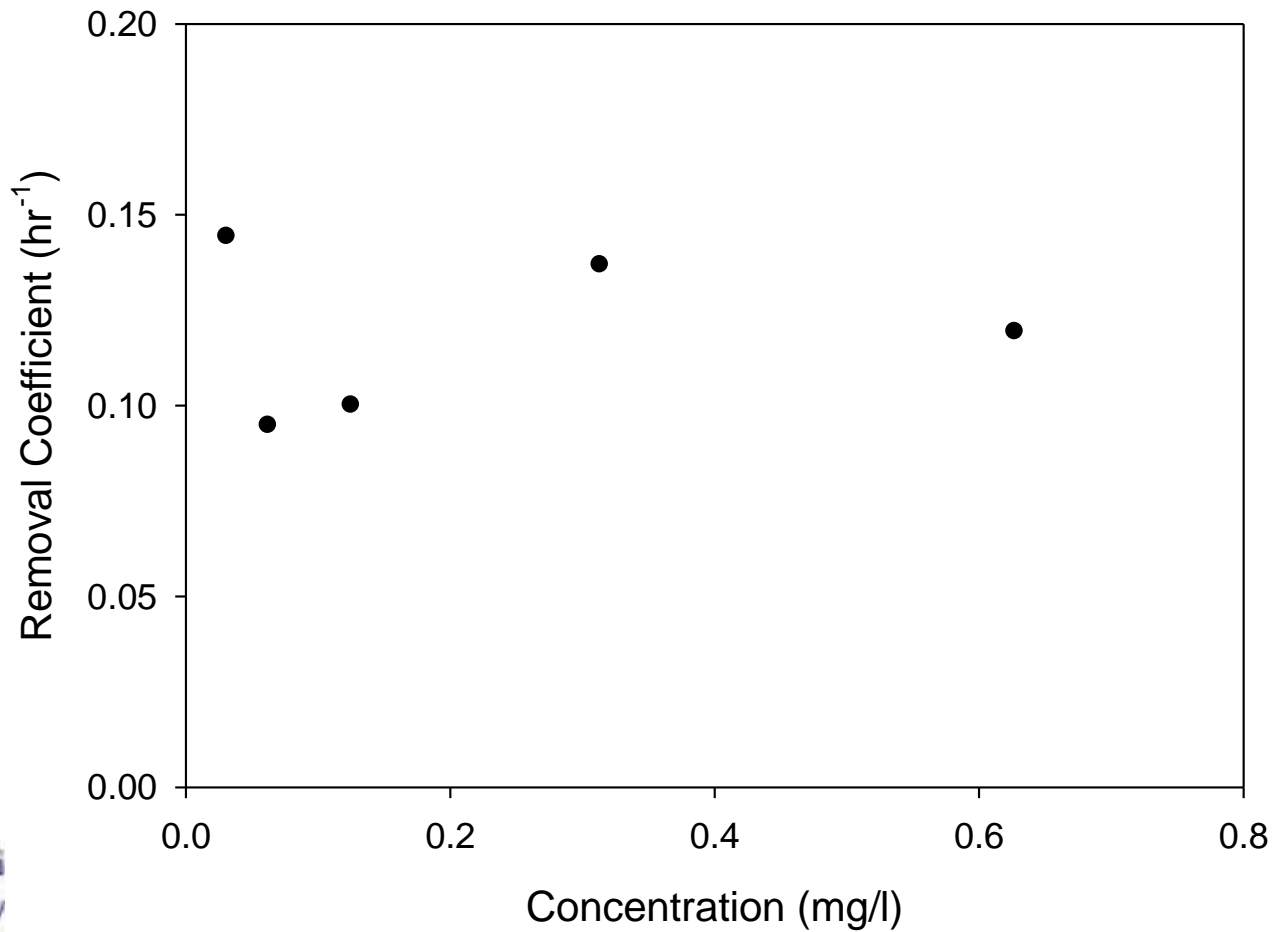
Removal through Filtration (BTEX)

$$\frac{K_c L}{v} = -\text{Ln}(1 - \text{fr})$$



Removal through Filtration (Iron)

$$\frac{K_c L}{v} = -\text{Ln}(1 - fr)$$



Iron Reduction



Landfill Soil

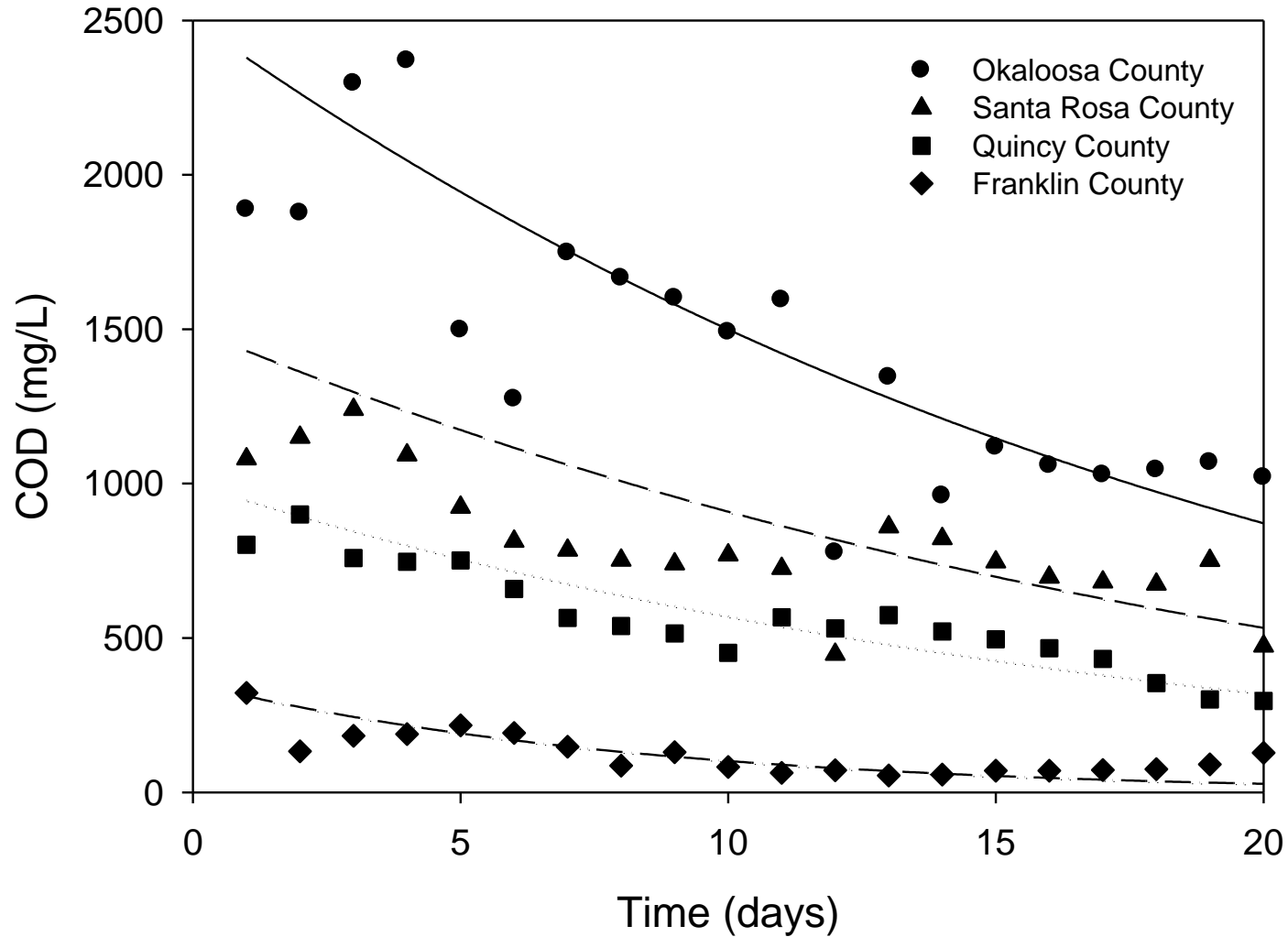


Iron Reducing Bacteria

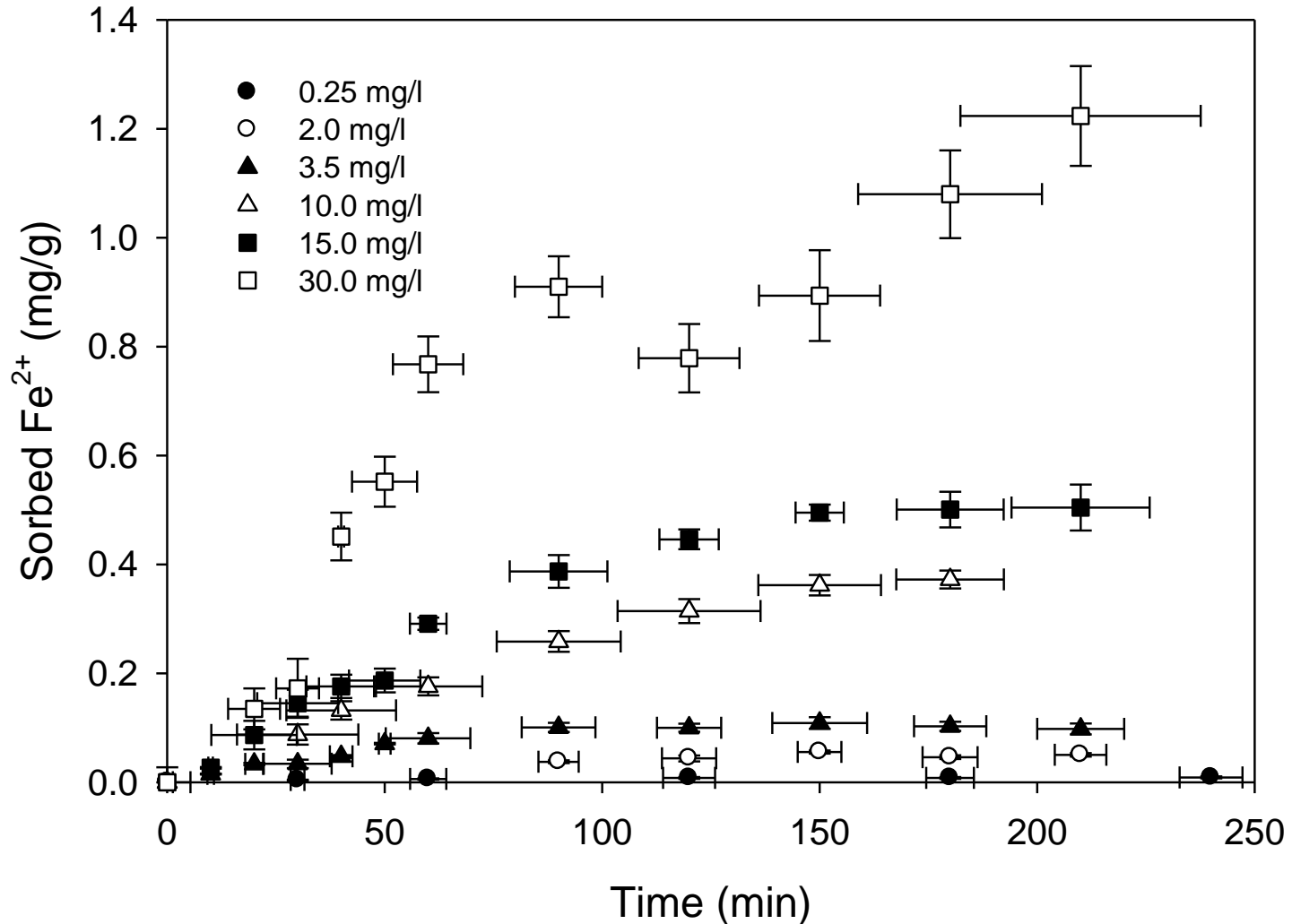


Landfill Leachate

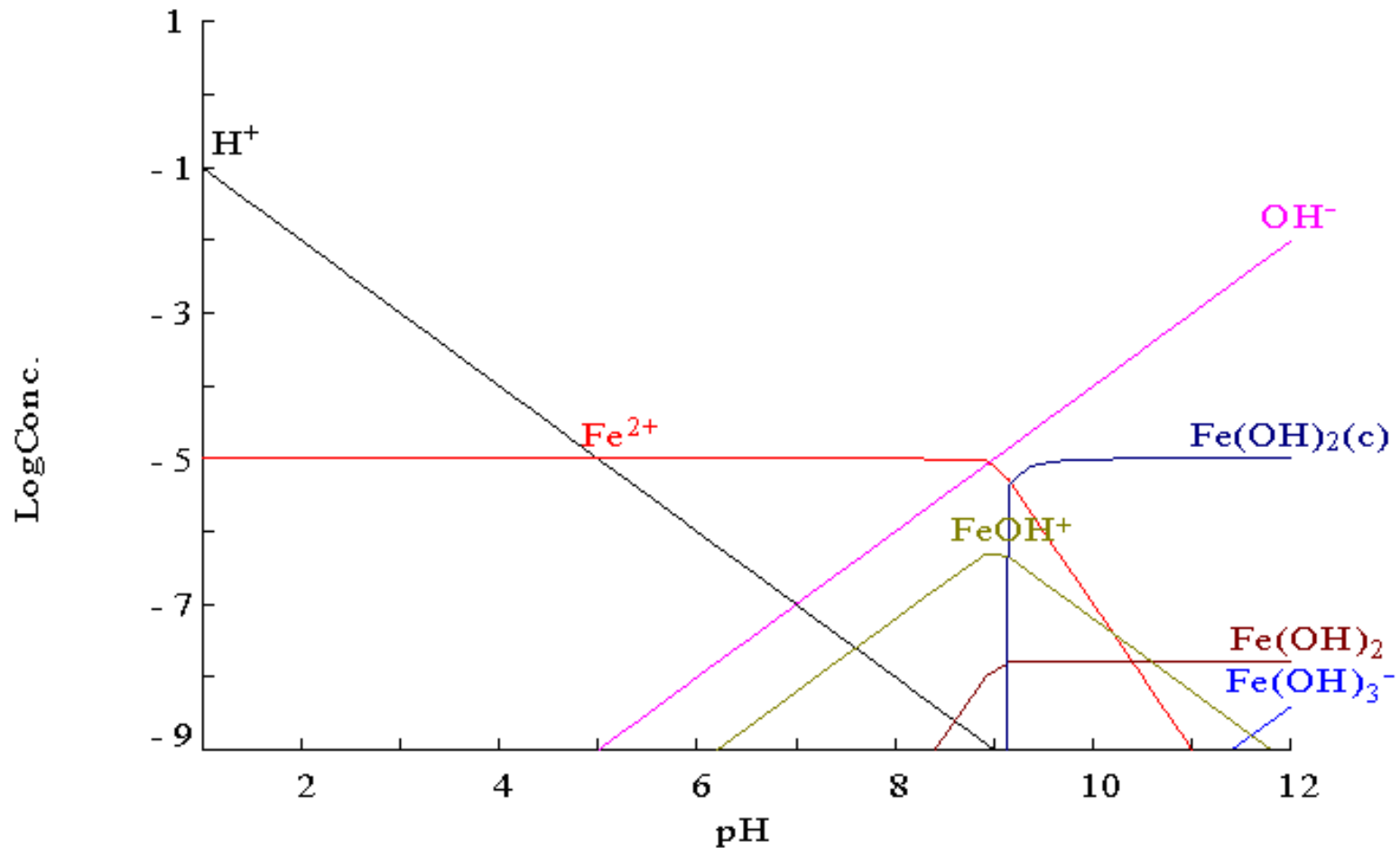
Ferrous Iron Release



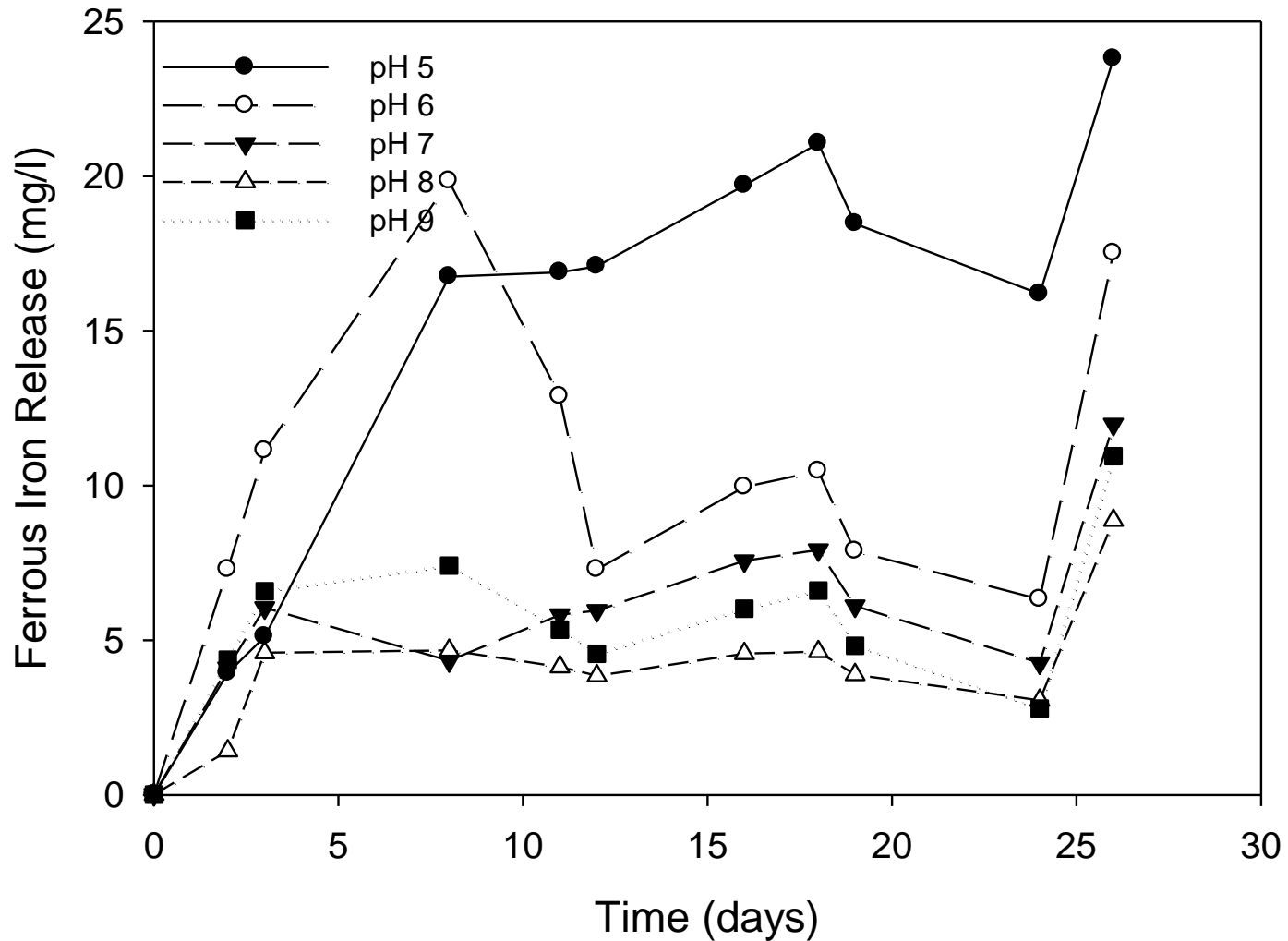
Ferrous Iron Sorption



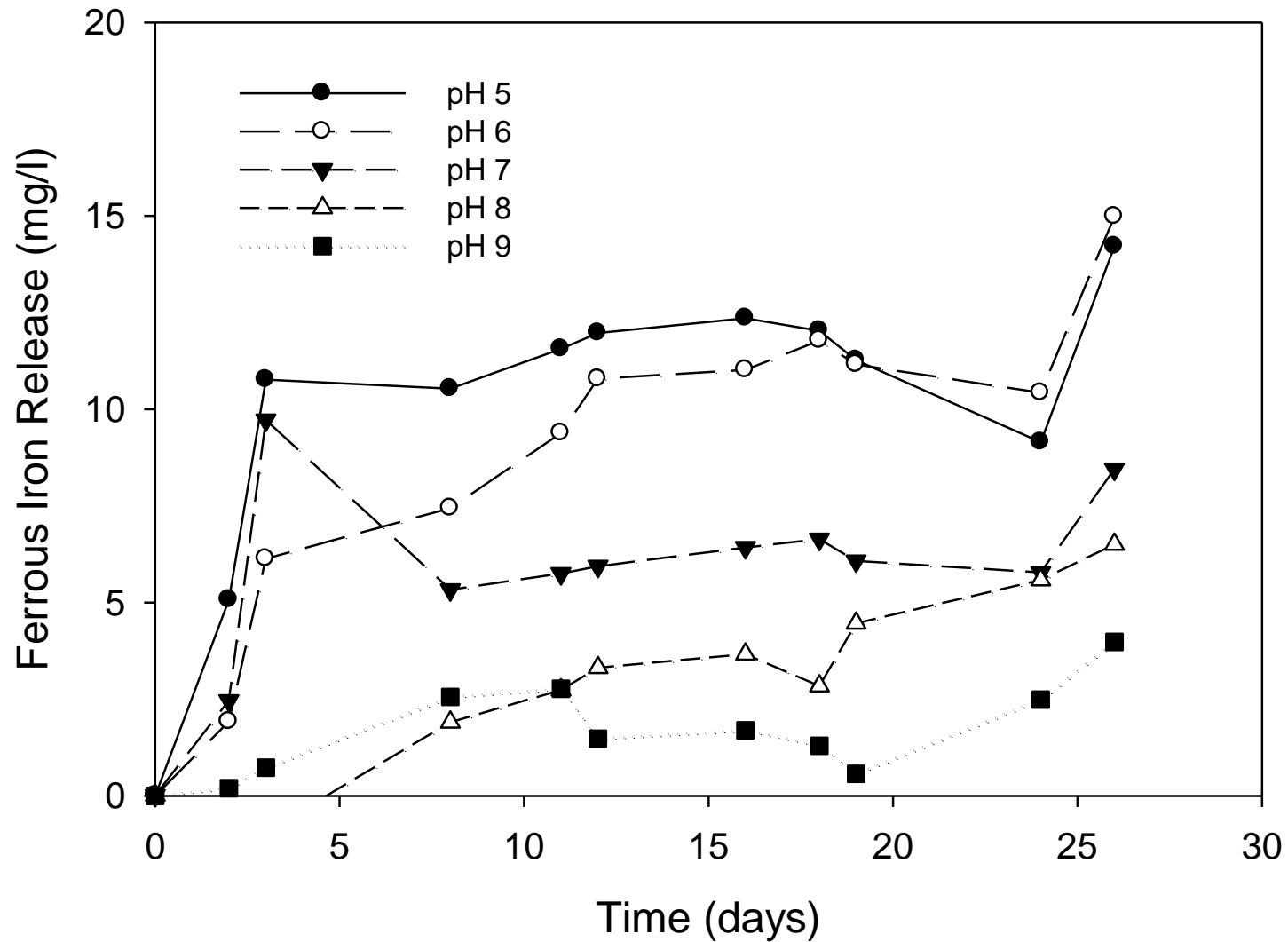
Ferrous Iron Speciation



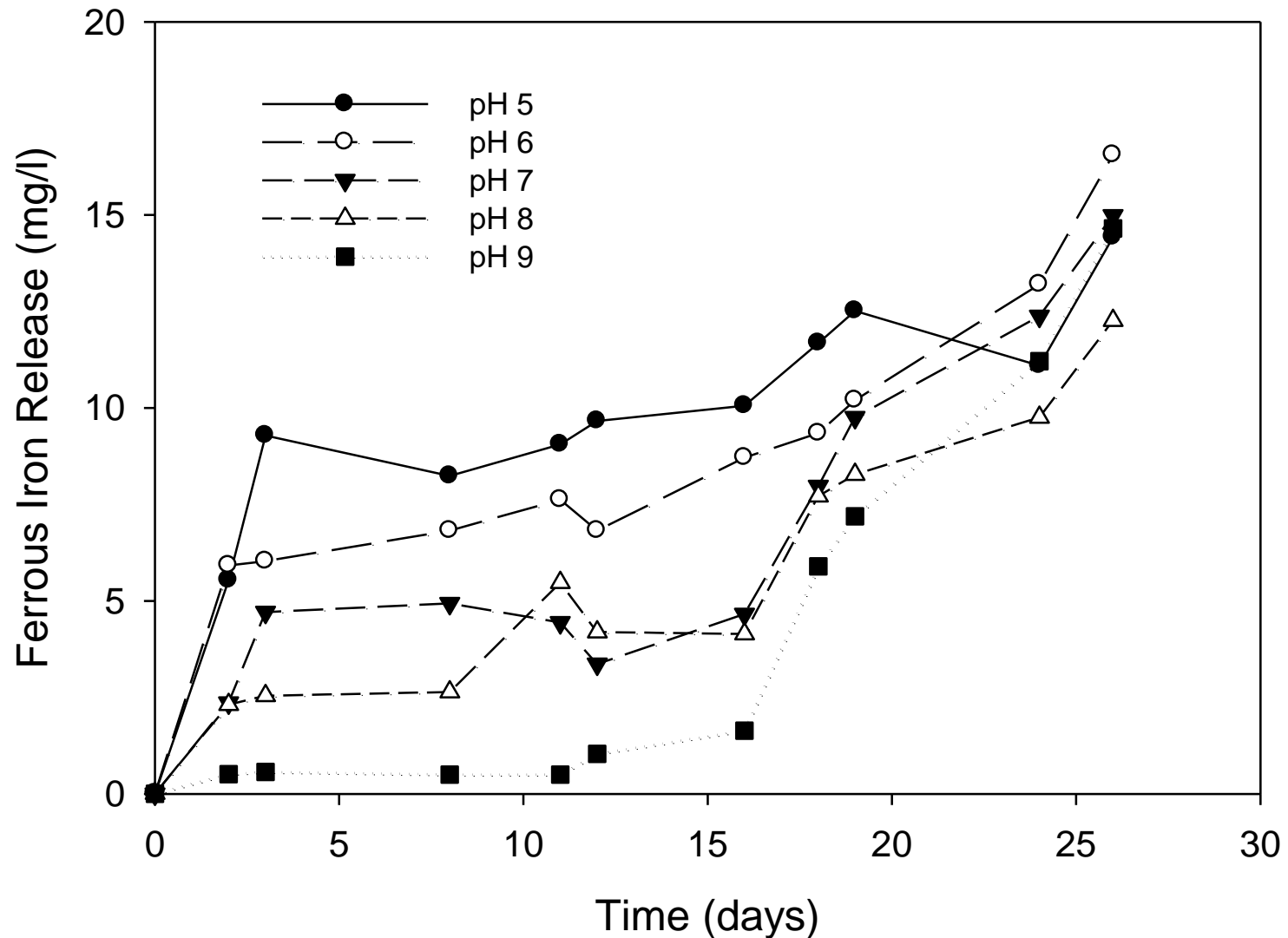
Ferrous Iron Release under Variable pH



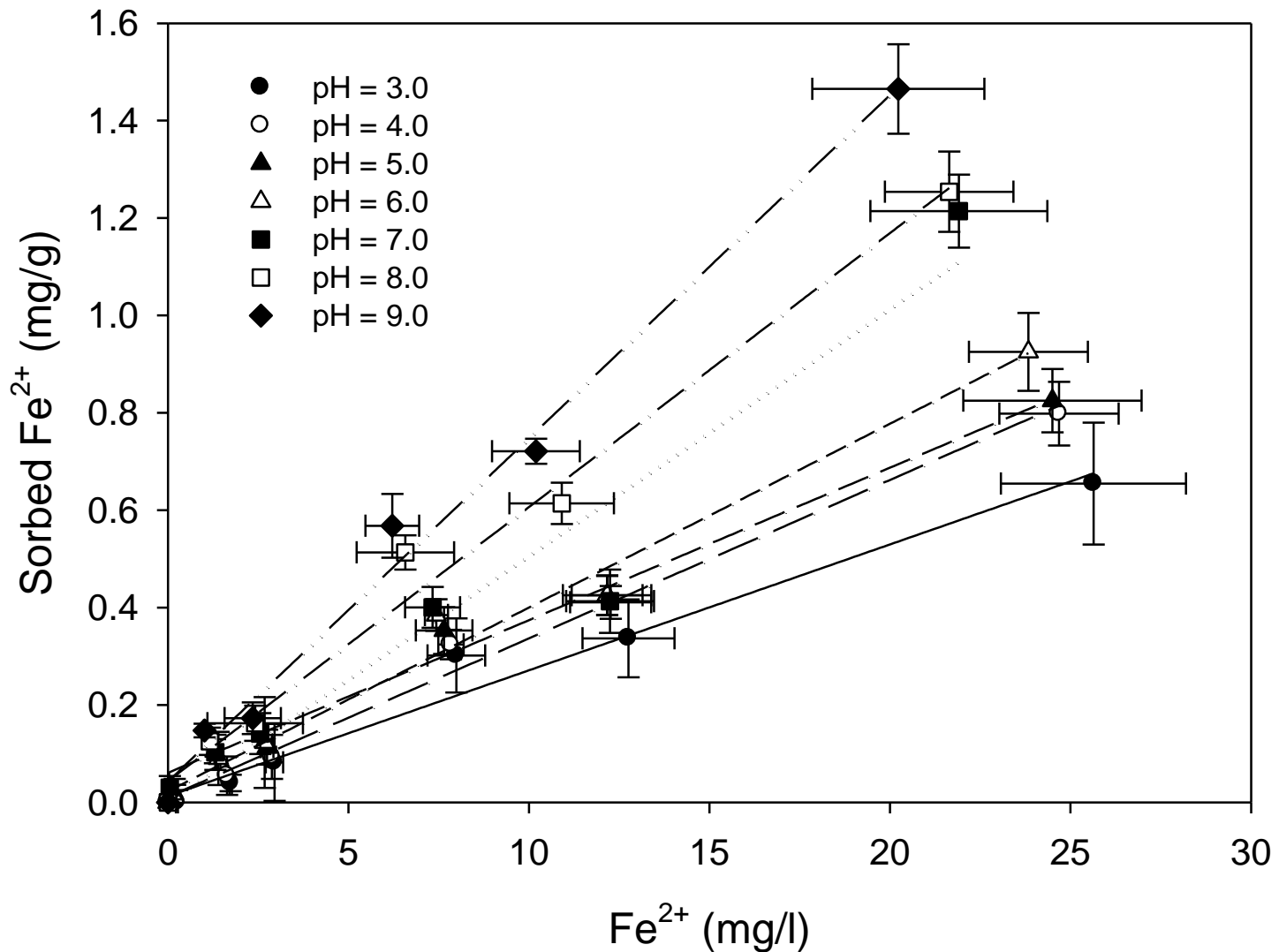
Ferrous Iron Release under Variable pH



Ferrous Iron Release under Variable pH



Ferrous Iron Sorption



Questions?

