

# PYRENE SORPTION TO AND EXTRACTION FROM CORN STOVER CHAR

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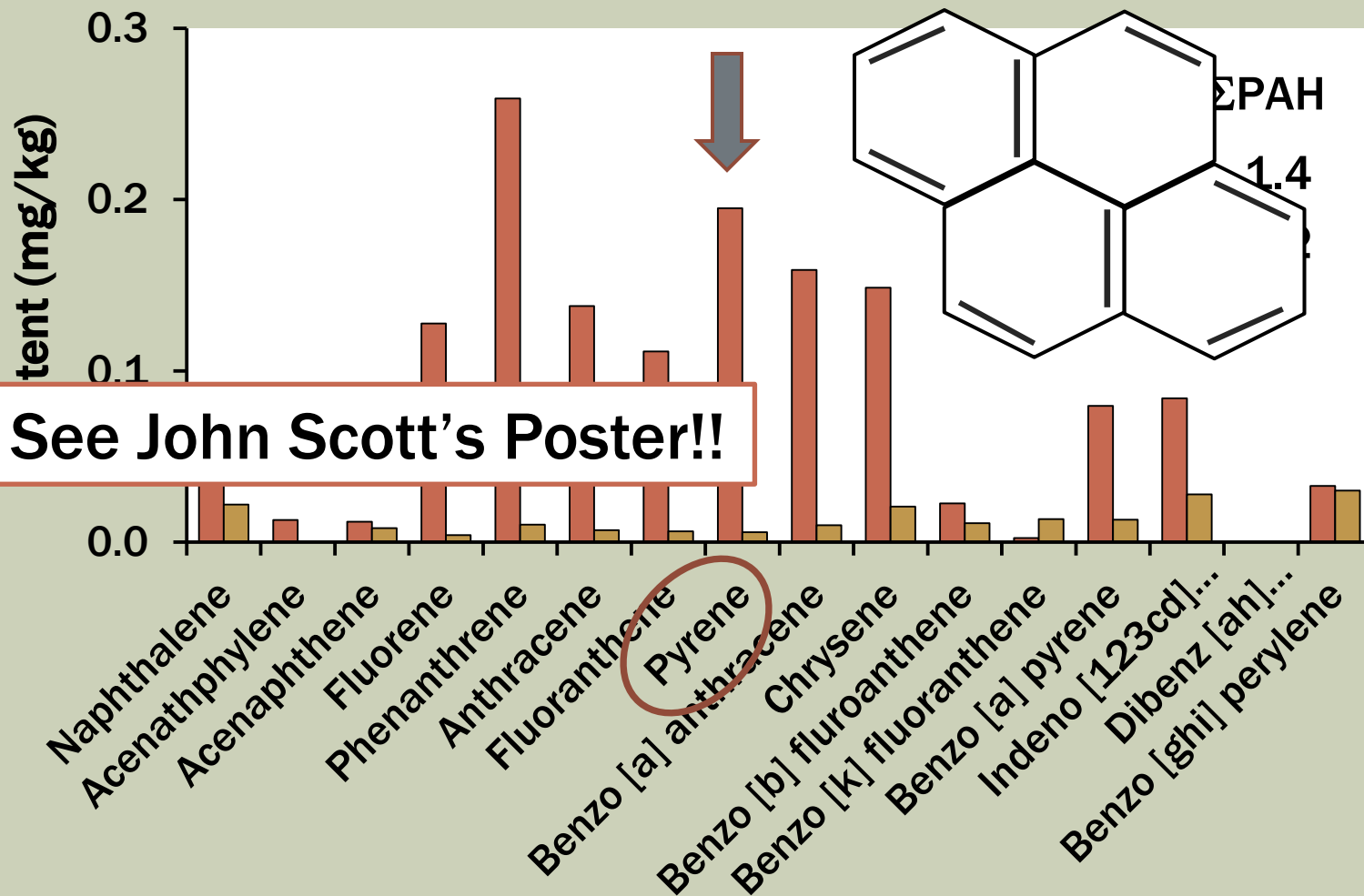
ILLINOIS

# BIOCHAR PREPARATION

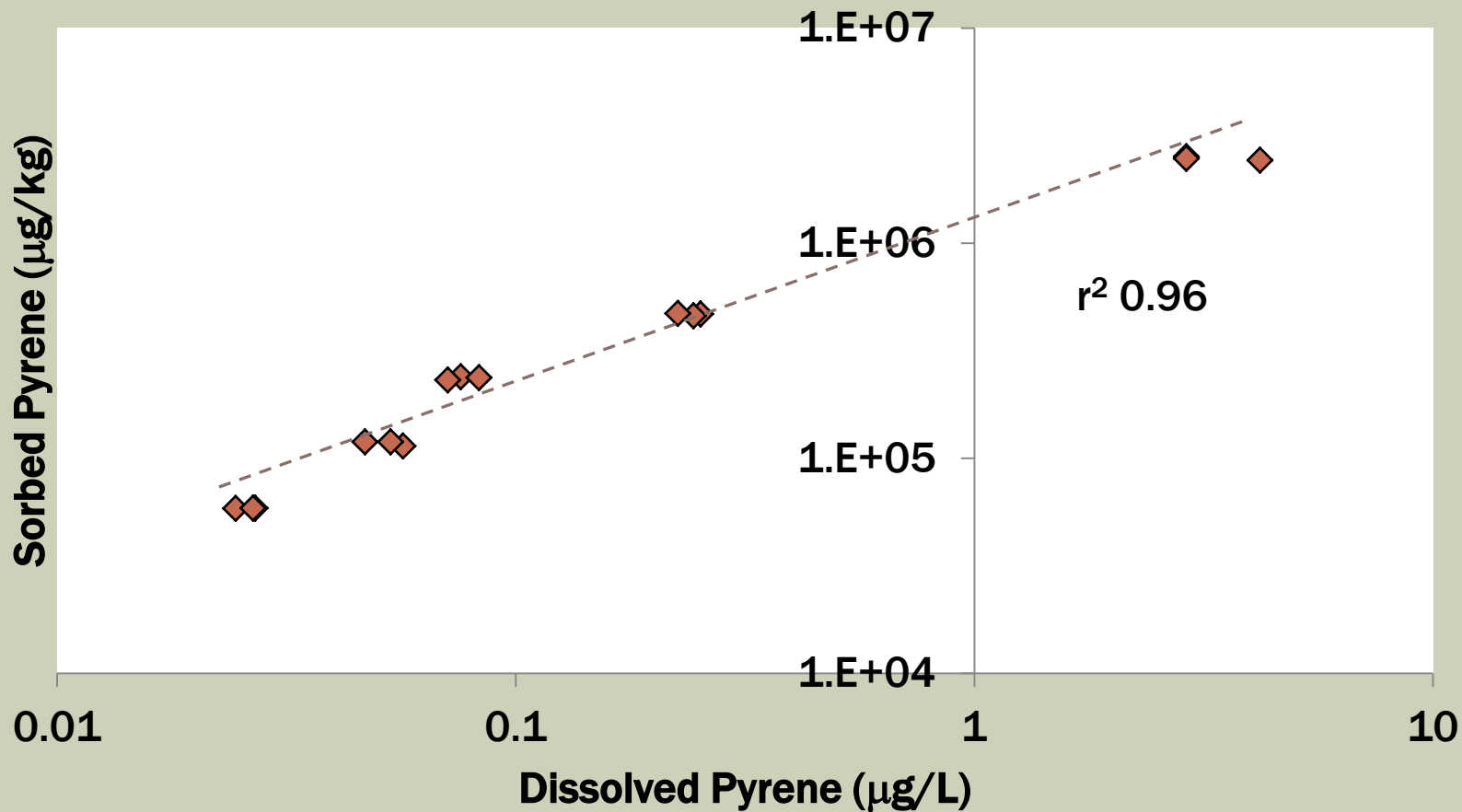
- Corn stover
- Pyrolysis
  - 450 °C
  - 550 °C
  - 750 °C
- N<sub>2</sub> atmosphere



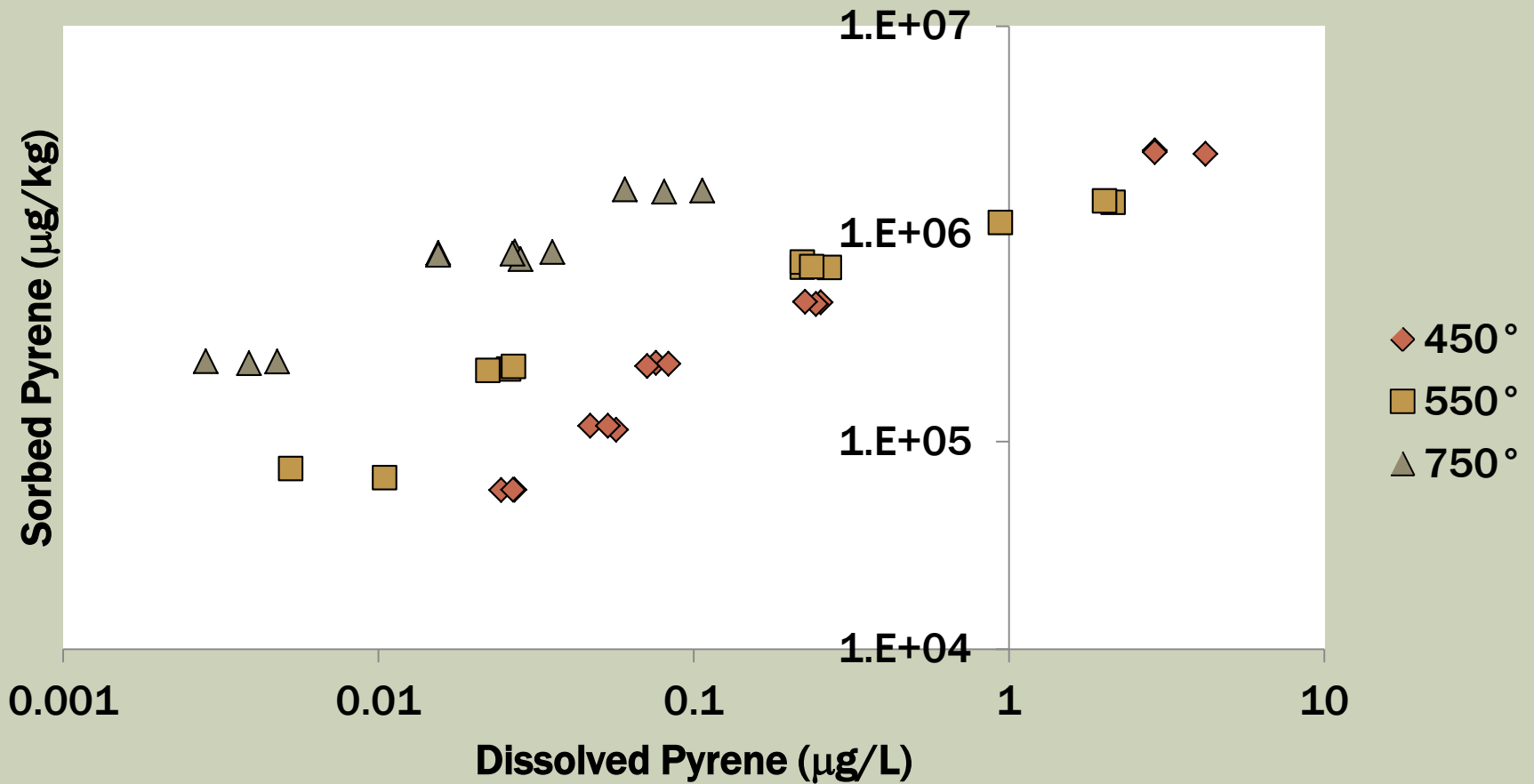
# USEPA-16 PAH CONTENT OF CORN STOVER CHAR



# SORPTION ISOTHERM 450° CHAR



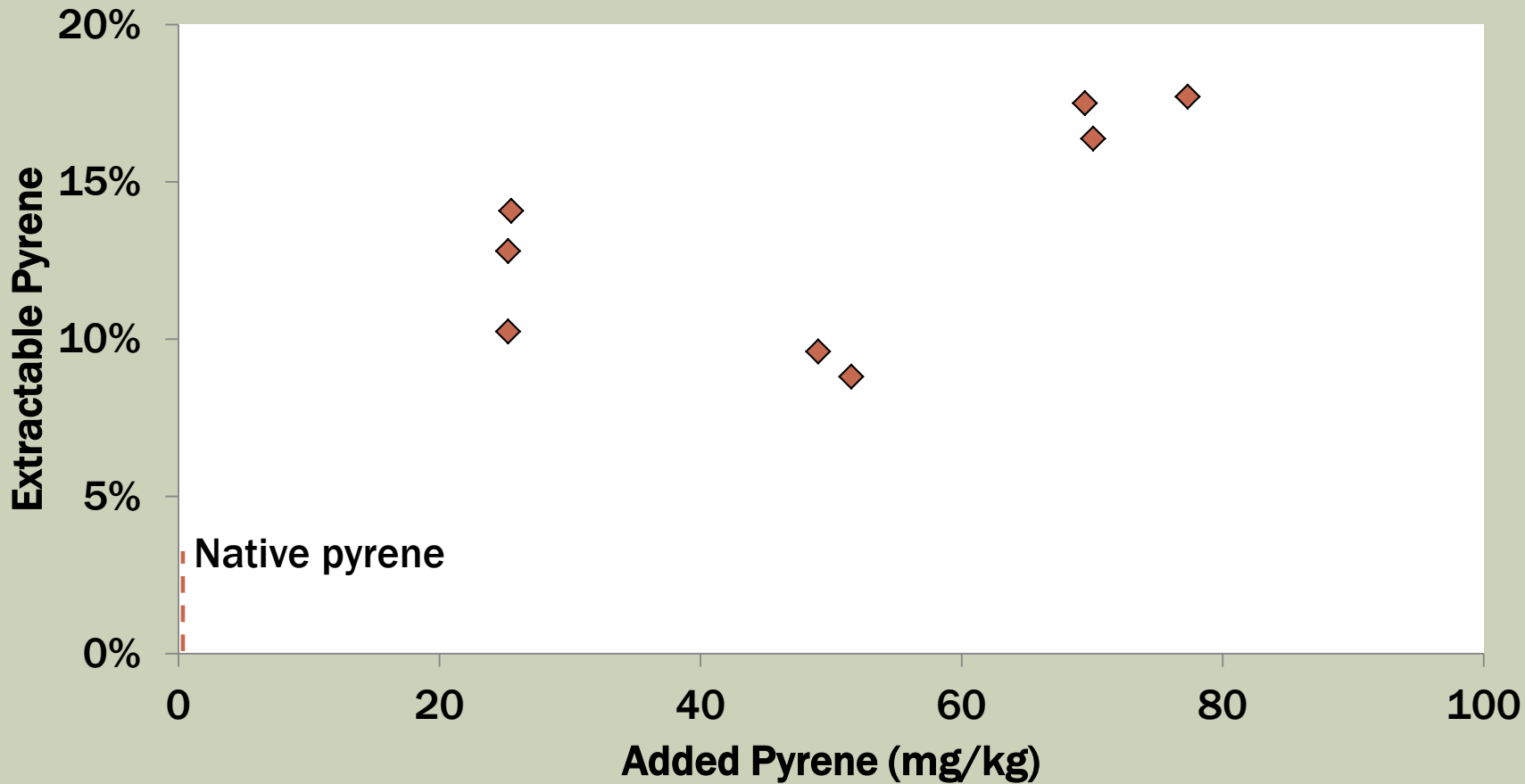
# SORPTION ISOTHERMS, FRESH CHAR



# BIOAVAILABILITY-RELATED EXPERIMENTS

- Mild extractions with 2-hydroxypropyl- $\beta$ -cyclodextrin (HPCD)
- HPCD-extractable PAHs correlate well with
  - Bioavailability
  - Biodegradation
- Poor correlation with total PAH content

# HPCD-EXTRACTABLE PYRENE 450 ° CHAR

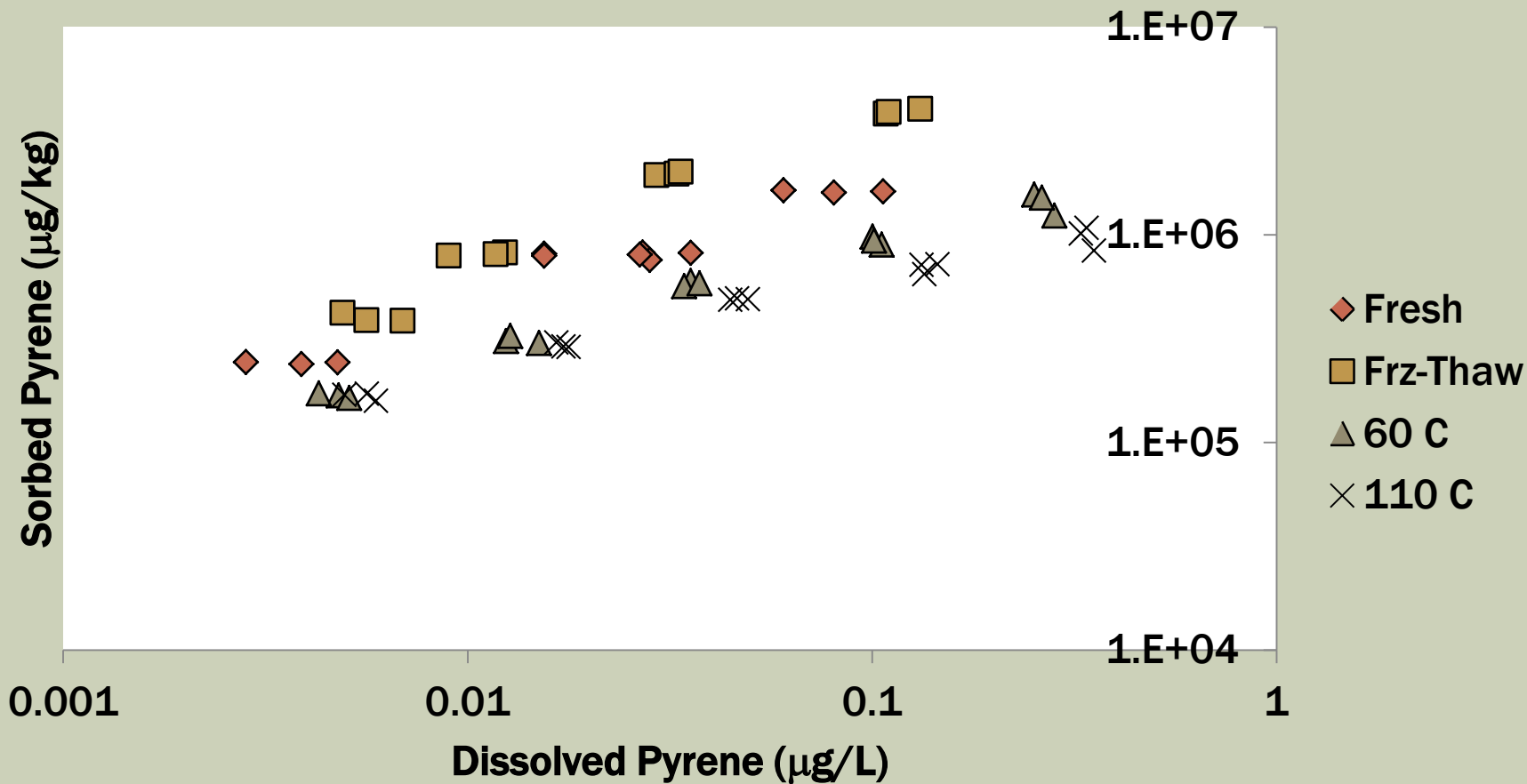


# ARTIFICIAL AGING

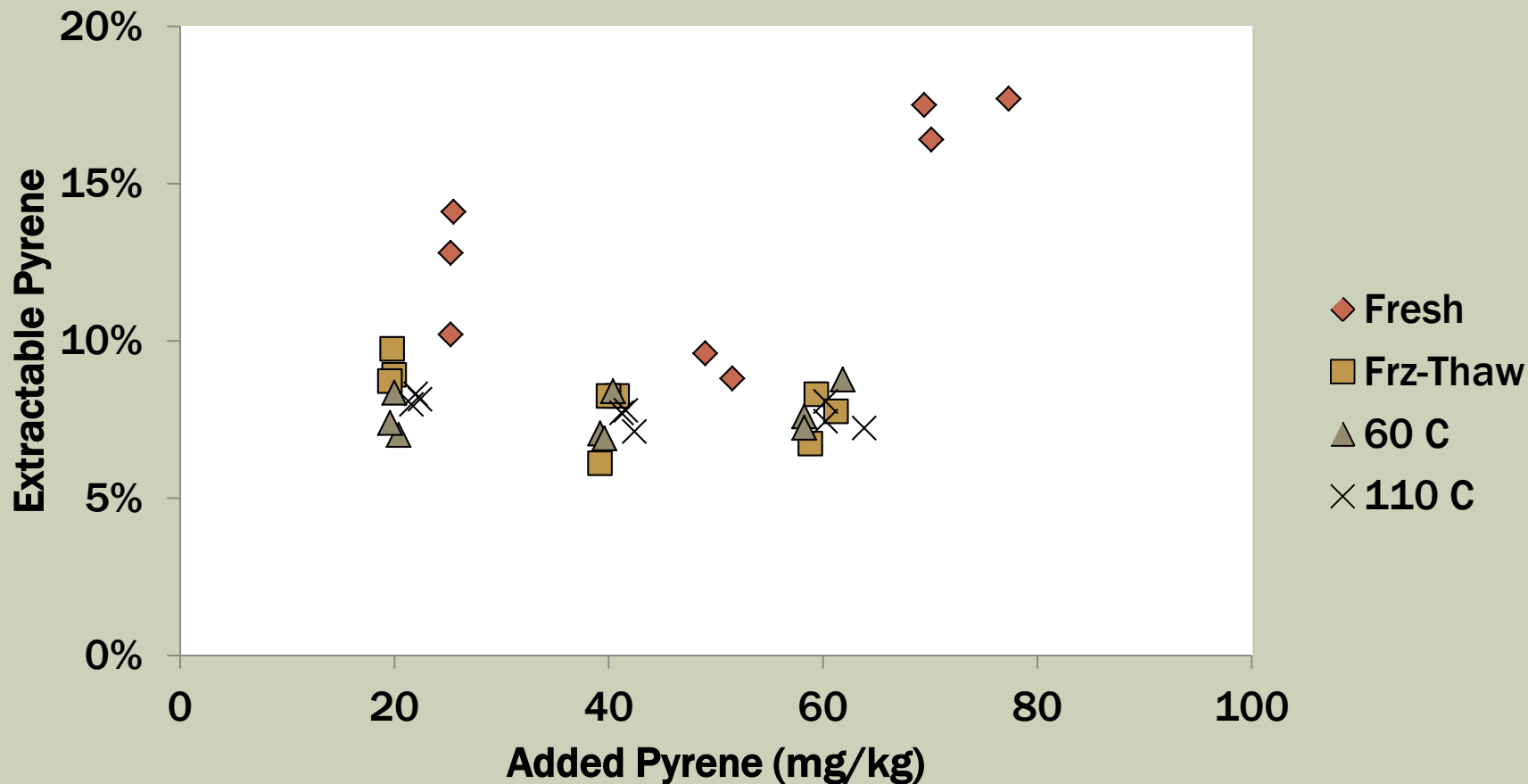
- Hale et al. (2011)
- 40% field capacity (moisture)
- Incubate 1 month
  - Freeze/Thaw
  - 60 ° C
  - 110 ° C



# SORPTION ISOTHERMS, AGED AND FRESH 750° CHAR

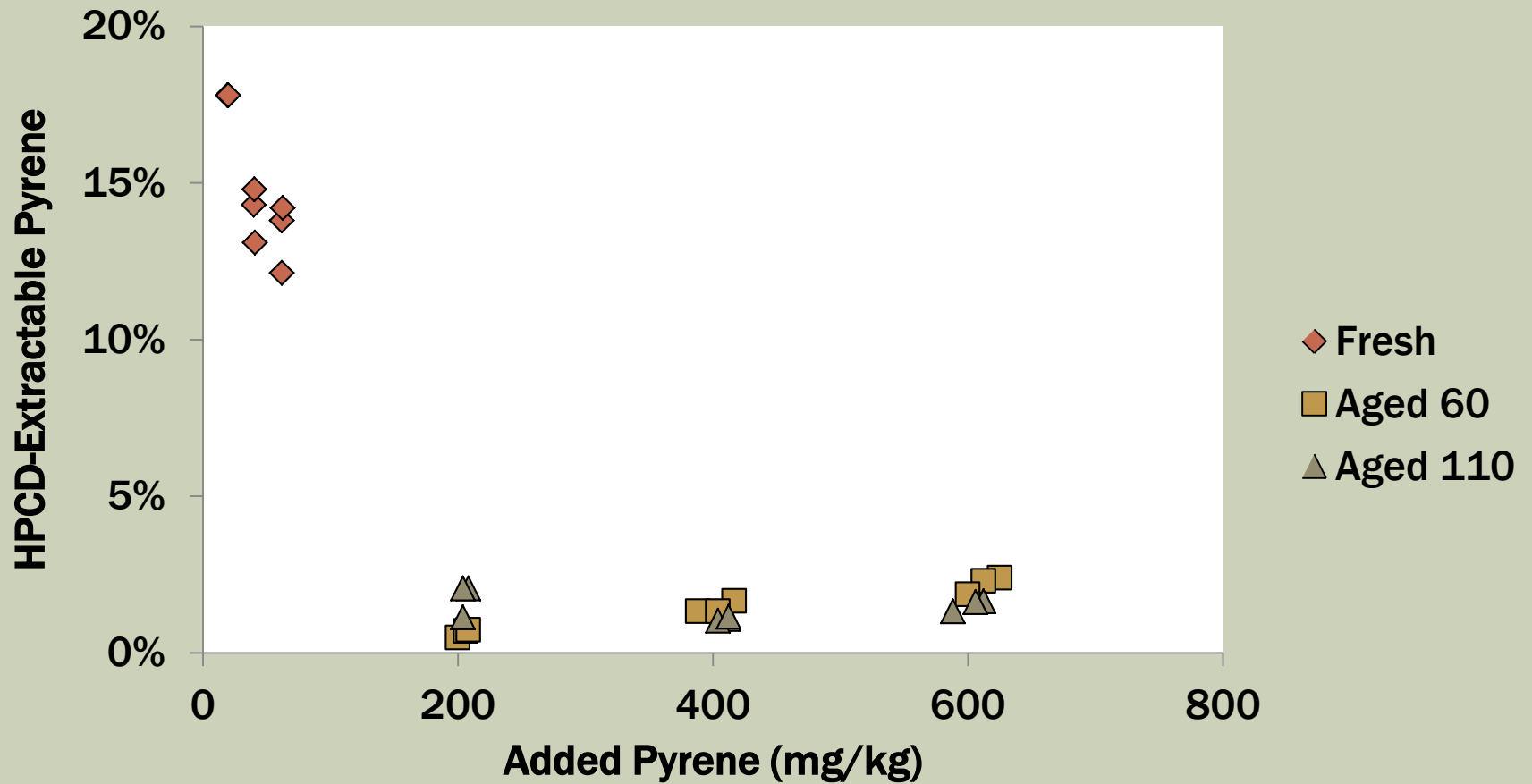


# HPCD-EXTRACTABLE PYRENE 450 ° CHAR, FRESH & AGED



# HPCD-EXTRACTABLE PYRENE

## 550 ° CHAR, FRESH & AGED



# CONCLUSIONS, PAH SORPTION

- PAHs sorb strongly to corn stover char
  - Freundlich isotherm
  - $6 < \text{Log } K < 7$  for fresh char
  - For native PAHs, solubility  $\ll 1$  ng/L

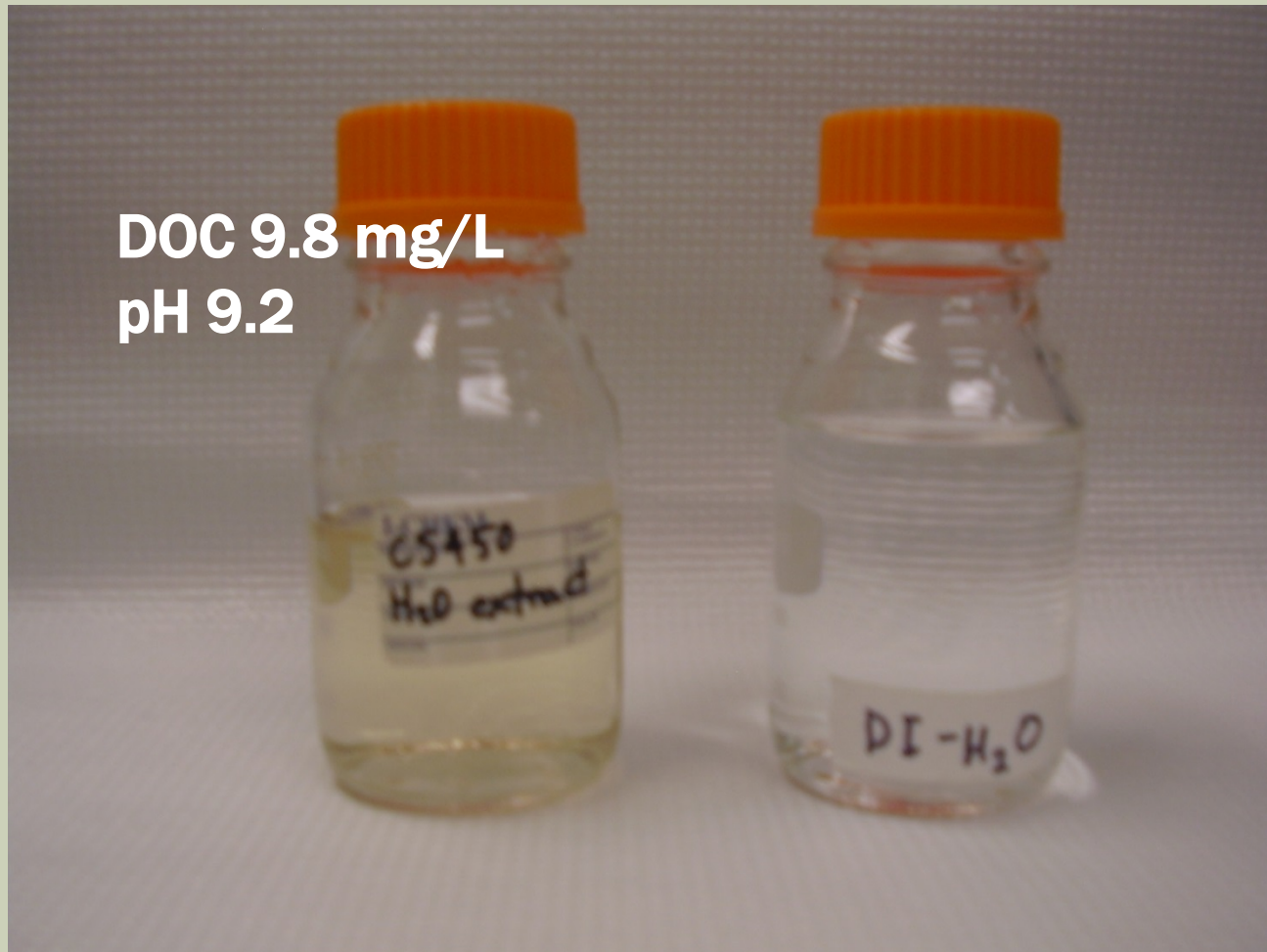
# CONCLUSIONS, PAH BIOAVAILABILITY

- Small fraction of pyrene is bioavailable (HPCD-extractable)
  - 10-15% 450° char
  - 1-3% 550°, 750° chars

# CONCLUSIONS, CHAR AGING

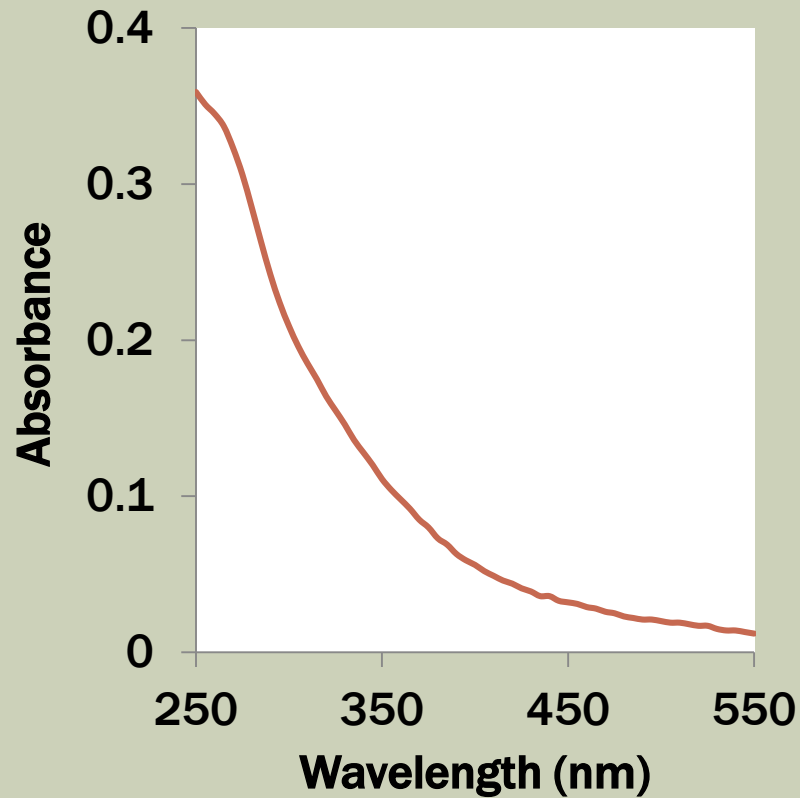
- (Artificial) aging has small effects on PAH sorption
  - $\Delta \text{Log } K$  for pyrene  $\leq 0.5$
- Aging effect on PAH bioavailability
  - 450° char: decrease
  - 550° char: large decrease (?)
  - 750° char: no effect

# WATER-SOLUBLE BLACK CARBON

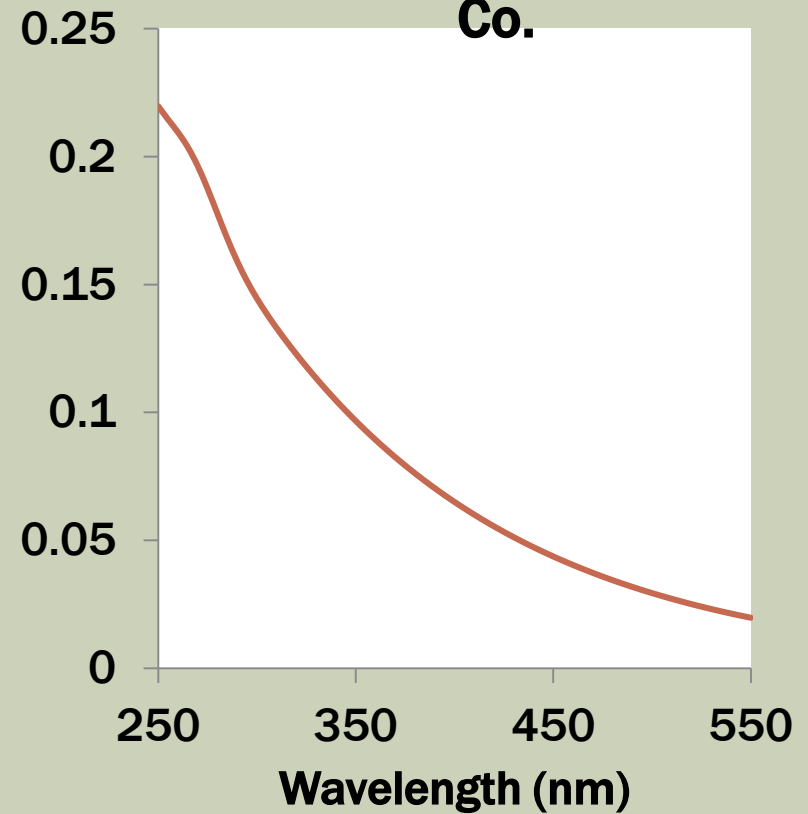


# ABSORBANCE SPECTRUM, WATER EXTRACT OF CS450

## CS450 Water Extract



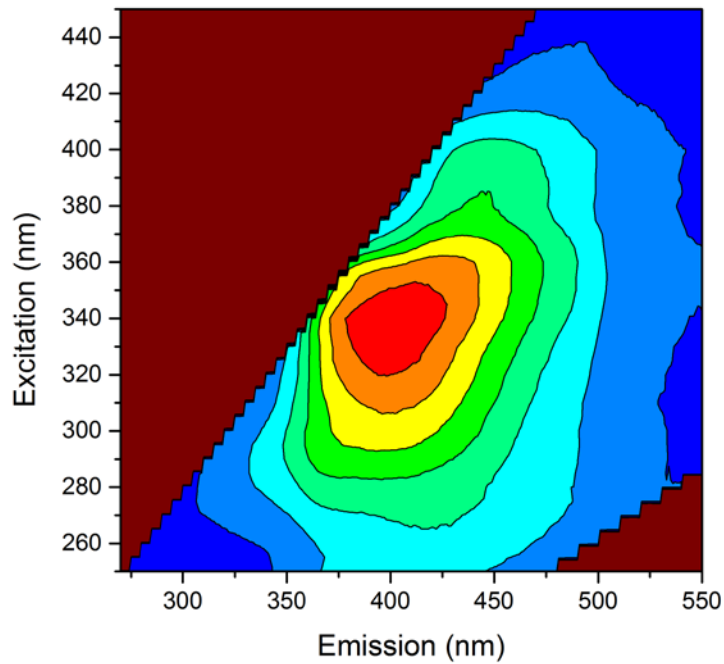
## Groundwater, Champaign Co.



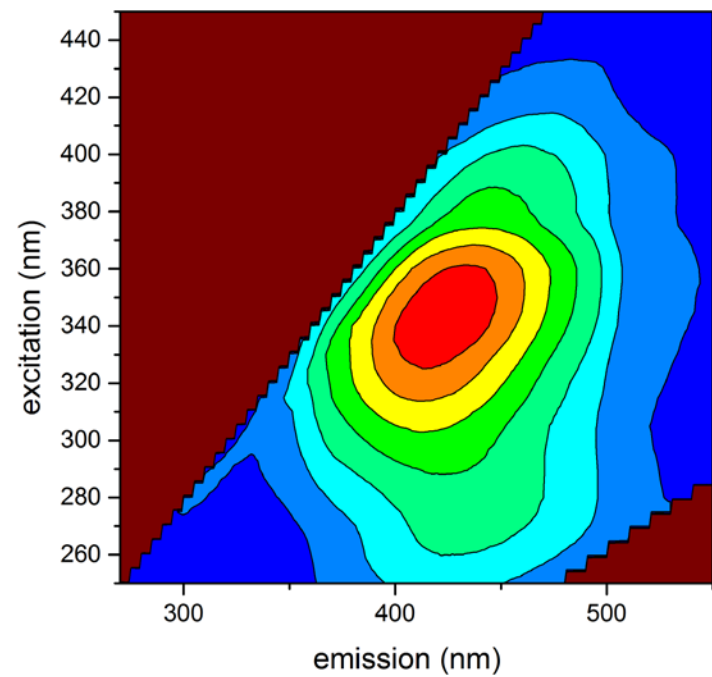


# FLUORESCENCE EXCITATION-EMISSION SPECTRA

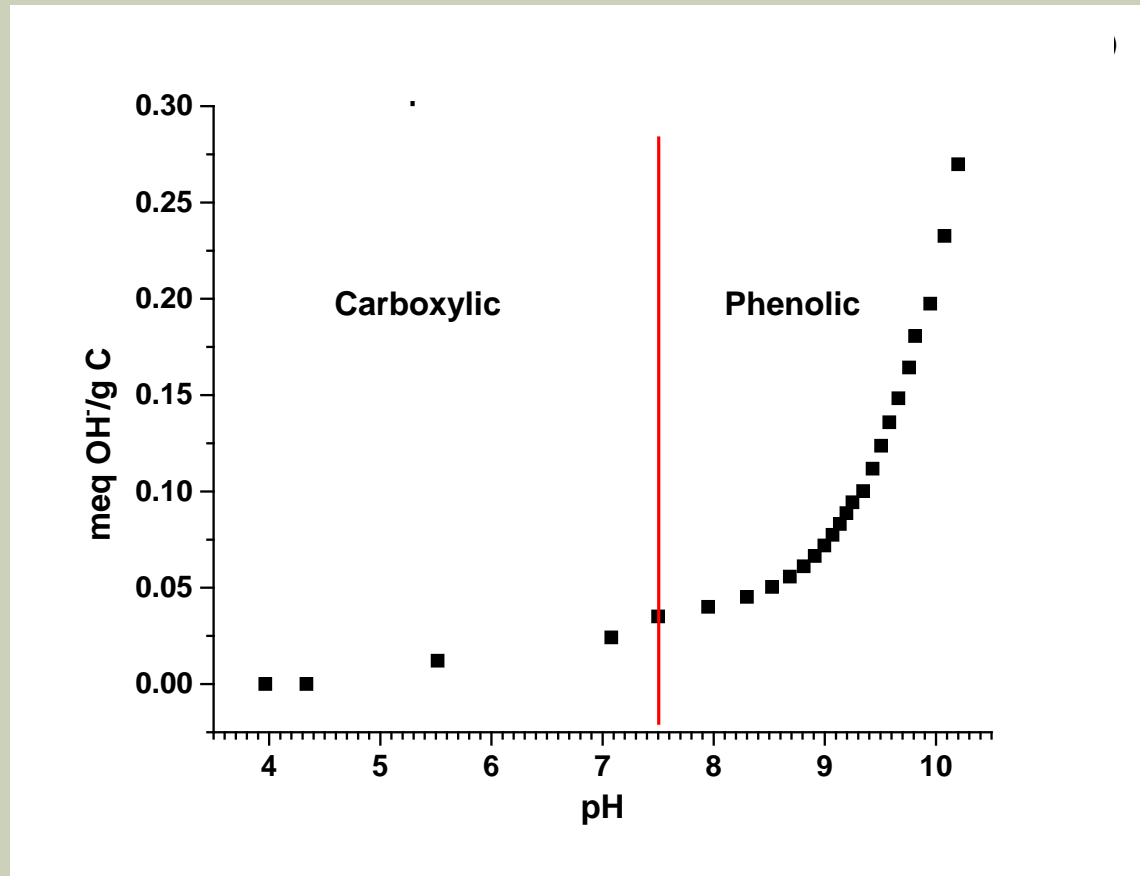
## CS450 Water Extract



## Groundwater, Champaign Co.



# BASE TITRATION, WATER EXTRACT OF CS450



# AKNOWLEDGEMENTS

- Will Gillespie, ISWS, for corn stover
- B. K. Sharma & Wei Zheng for biochar pyrolysis
- Jill O'Connell for assistance with experiments
- Illinois Sustainable Technology Center for project support

