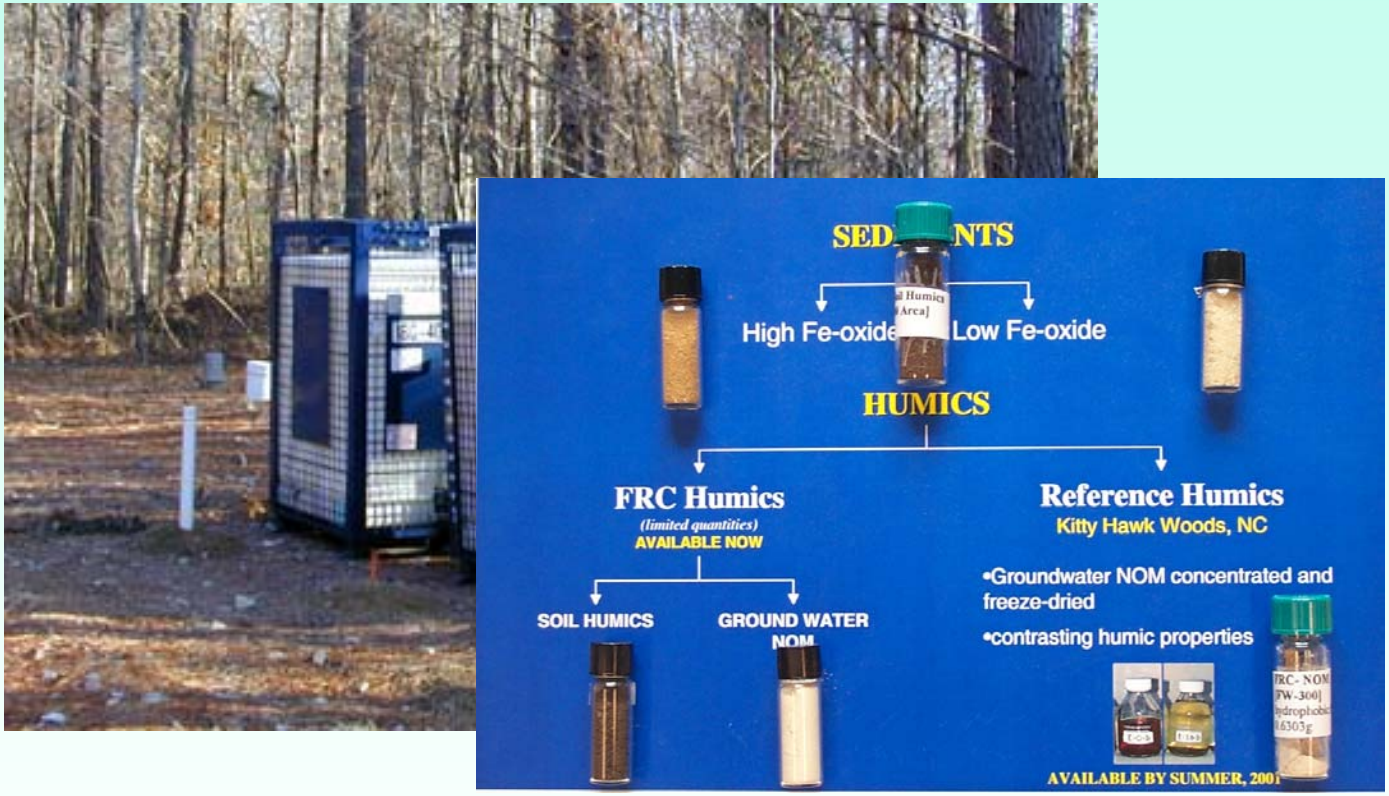
Humic Reference Materials



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Purpose

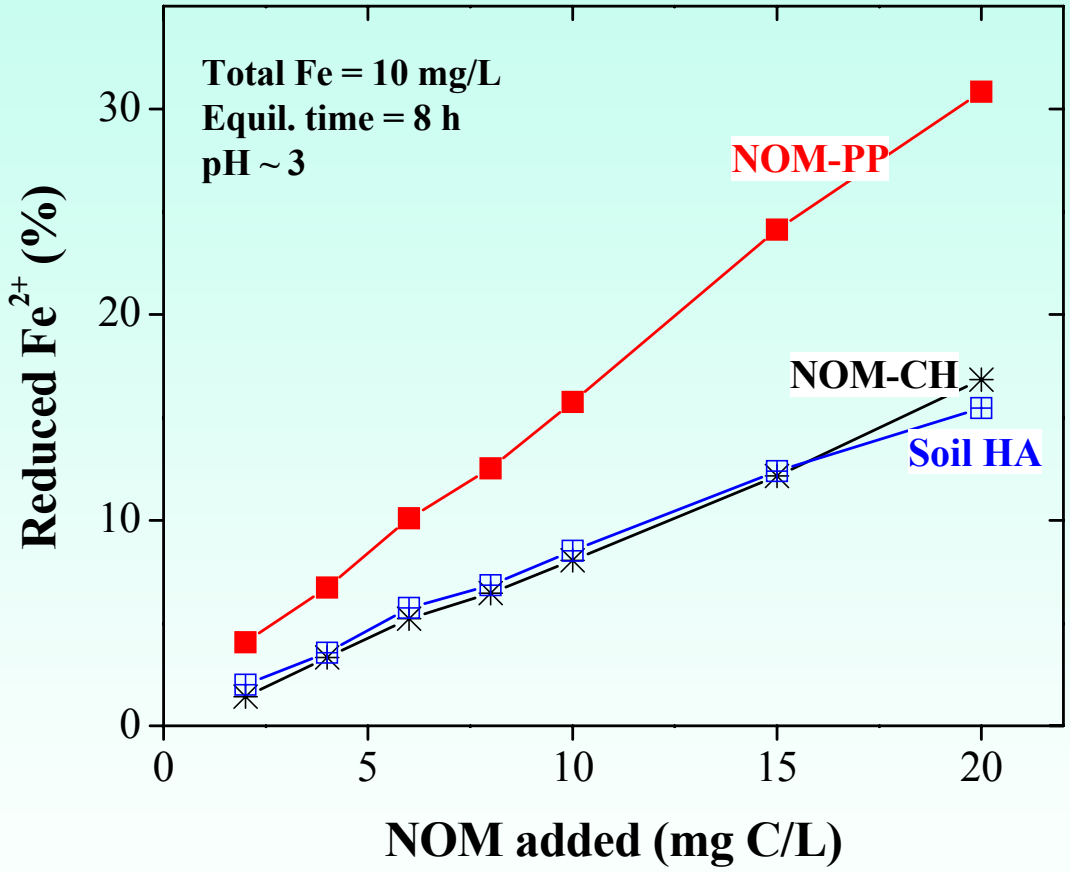
- **Provide well-characterized, field-relevant humic substances or natural organic matter (NOM) to interested NABIR researchers.**

- **Promote coordination of research efforts, facilitate comparisons of results from individual researchers, and integrate understanding of complex environmental processes.**

Impact of Humic Substances

- Ubiquitous
- Soils or sediments commonly coated with humics
- Redox reactive – effects on metal reduction/oxidation
- Functional groups – metal complexation
- Impact on metal mobilization or immobilization

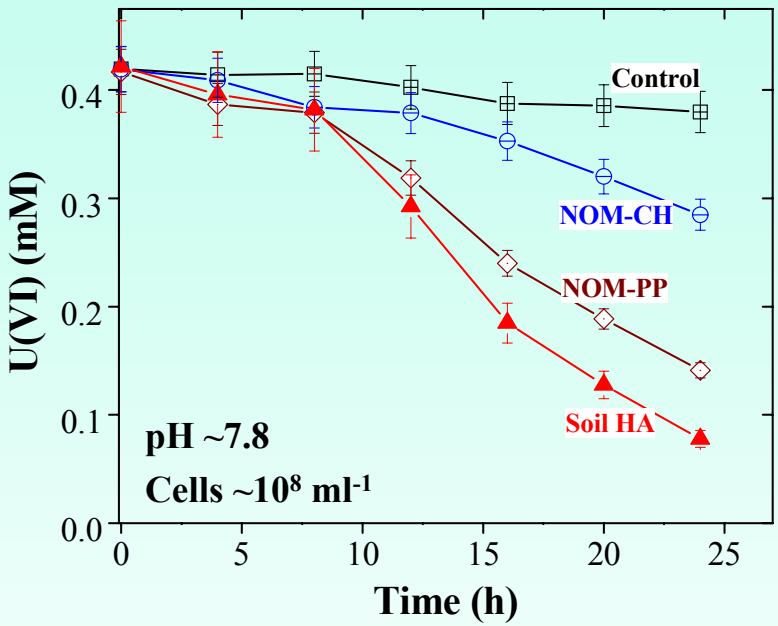
Fe(III) can be Chemically Reduced by Humic Substances

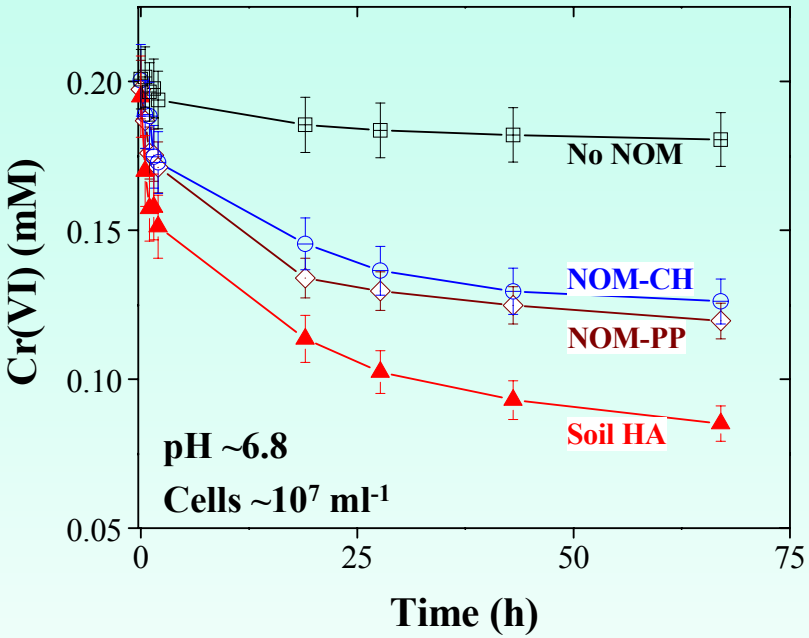


- Humic substances are redox reactive.
- Humics can chemically reduce Fe(III) at a low pH.
- Different humics show varying kinetics and capacities in reducing Fe(III).

(Data from Chen et al.)

Roles of Humic Substances in Bioreduction of U(VI) and Cr(VI)

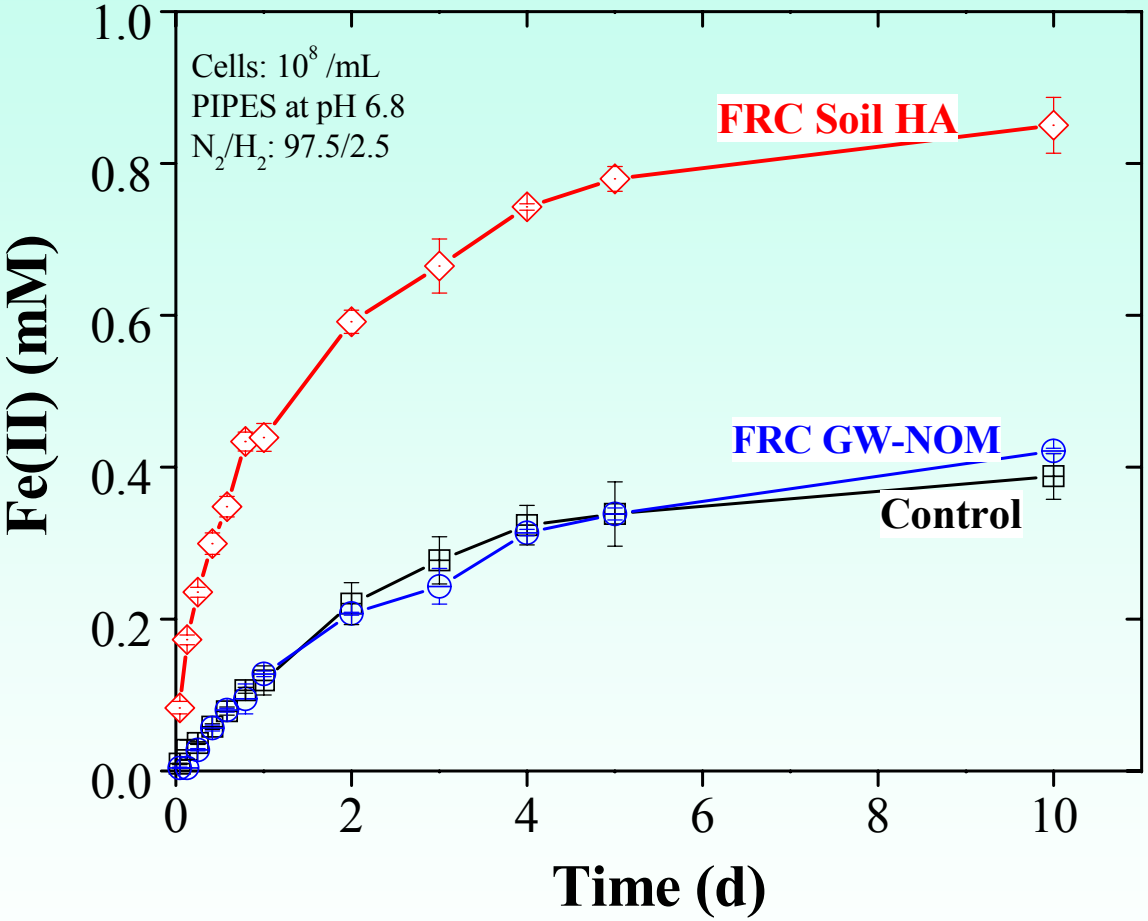




- **Humic substances enhance the bioreduction of U(VI), Cr(VI), and Fe(III).**
- **Different humic subfractions play different roles in metal reduction.**

(Data from Gu et al.)

Roles of FRC Humics in Fe(III) Bioreduction



- **FRC soil humic acid enhanced the bioreduction of hematite.**
- **Soil humic acid was more effective than groundwater NOM in reducing Fe(III).**

(Data from Royer and Burgos at PSU)

Humic Reference Materials available

- FRC forest soil humic acid: ~0. 4 g.
- FRC forest soil fulvic acid: to be obtained.
- FRC groundwater bulk NOM - ~3 g (w/ salts).
- FRC groundwater hydrophobic NOM: ~5 g (w/ salts).
- Kitty Hawk Woods NOM (E-0-D): ~100 g (w/salts).
- Georgetown NOM (GT-NOM): ~40 g (purified).

Extraction of FRC Humic Substances

- Uncontaminated top soils used for extracting soil humic and fulvic acids.
- FW-300 well used for extracting groundwater humics (or NOM).

Purification and Characterization of Humics

PURIFICATION

- Acid washed or ion exchanged, freeze dried.

BASIC CHARACTERIZATION

- Elemental analysis – C, O, H, N.
- Trace metal impurities – Al, Fe, Cu, Ca, Mg, Mn, Si…

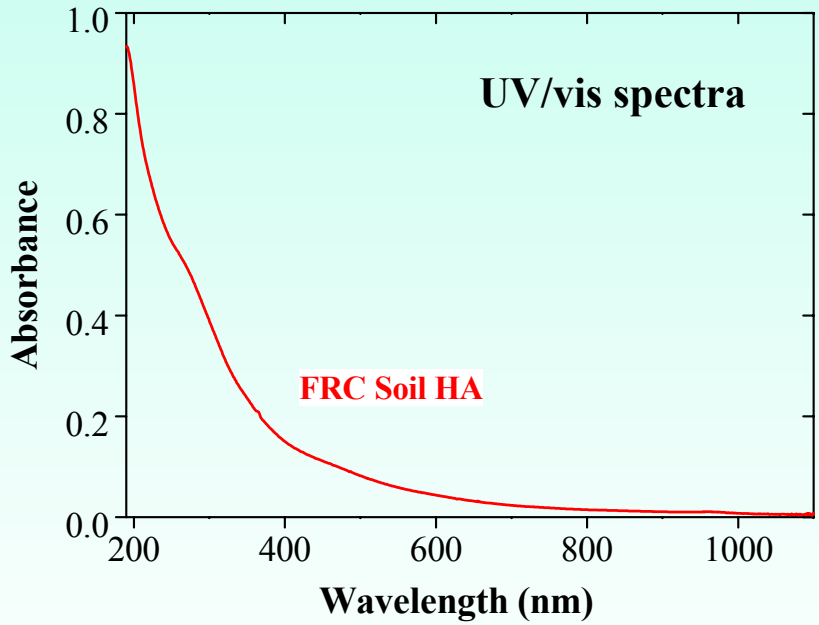
Characterization of FRC Humic Substances

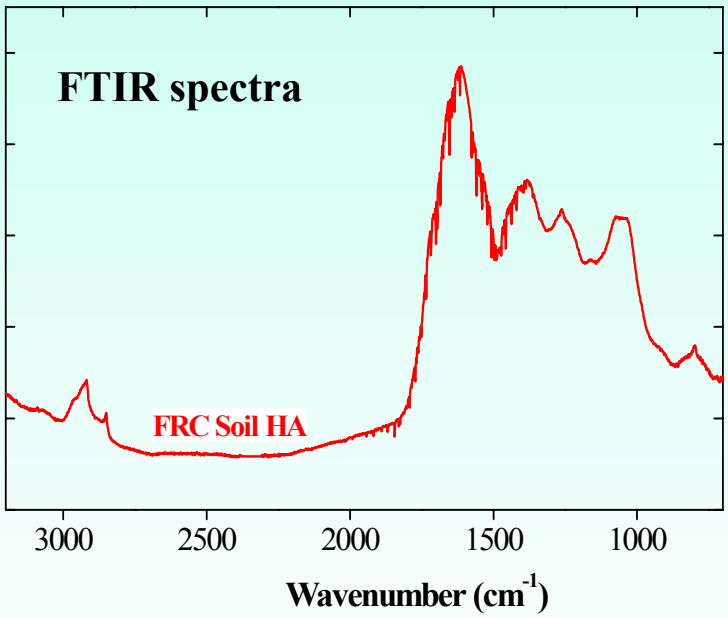
ADVANCED SPECTROSCOPIC CHARACTERIZATION

- **UV-Vis spectra – Estimating aromaticity.**
- **FTIR / Raman analyses – Functional groups and structure.**
- **^{13}C-NMR analysis – Functional groups and aromaticity.**
- **Fluorescence – Fluorophores, conjugated aromatic structures.**
- **ESR (or EPR) – Free radicals.**

Advanced Spectroscopic Characterization

- **FRC Forest Soil Humic Acid**





(examples)

Humics available

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