

# **Panel 5: Engineered Nanoparticles and Environmental Exposure**

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Instrumentation, Metrology, and Analytical Methods**

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## ***How Environmental Exposures Occur and Change under Different Environmental Conditions***

### ***Evaluate abiotic, and ecosystem-wide, effects***

- 1. What is the state of research at the current time?***
- 2. Are research needs provided by NNI complete?***
- 3. Which research needs should be addressed in near-, medium-, and longer-term?***

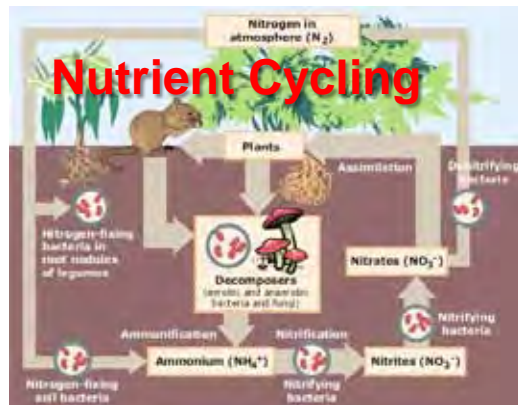
**How does the Nanoparticle  
effect the Environment?**



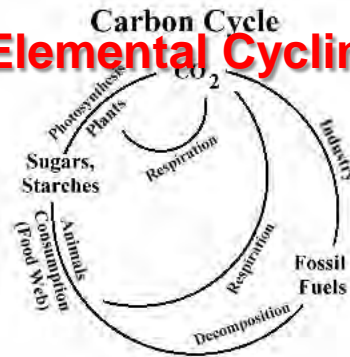
**How does the Environment  
effect the Nanoparticle?**

# Abiotic and Ecosystem-wide Effects

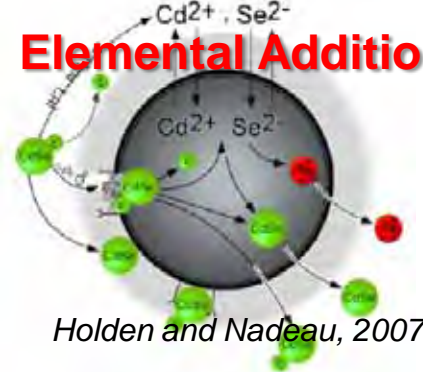
## Nutrient Cycling



## Elemental Cycling



## Elemental Addition



## Food Chain

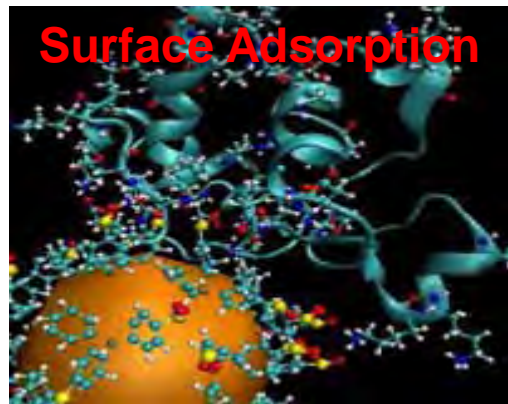


How does the Nanoparticle effect the Environment?

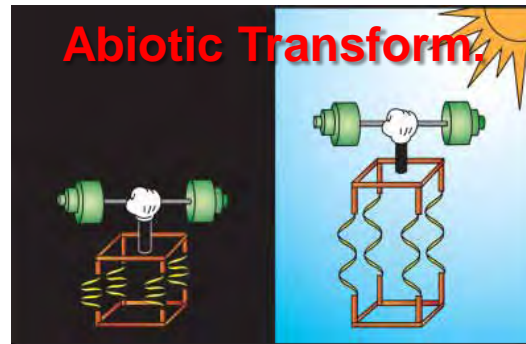


How does the Environment effect the Nanoparticle?

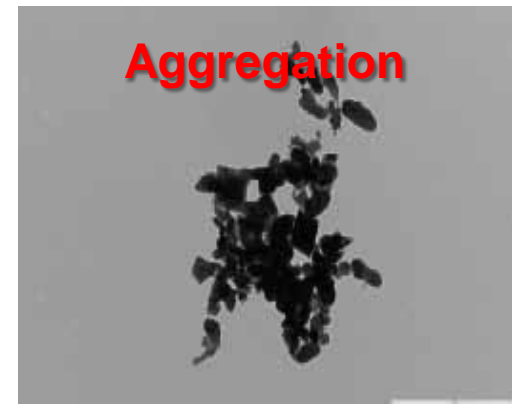
## Surface Adsorption



## Abiotic Transform.

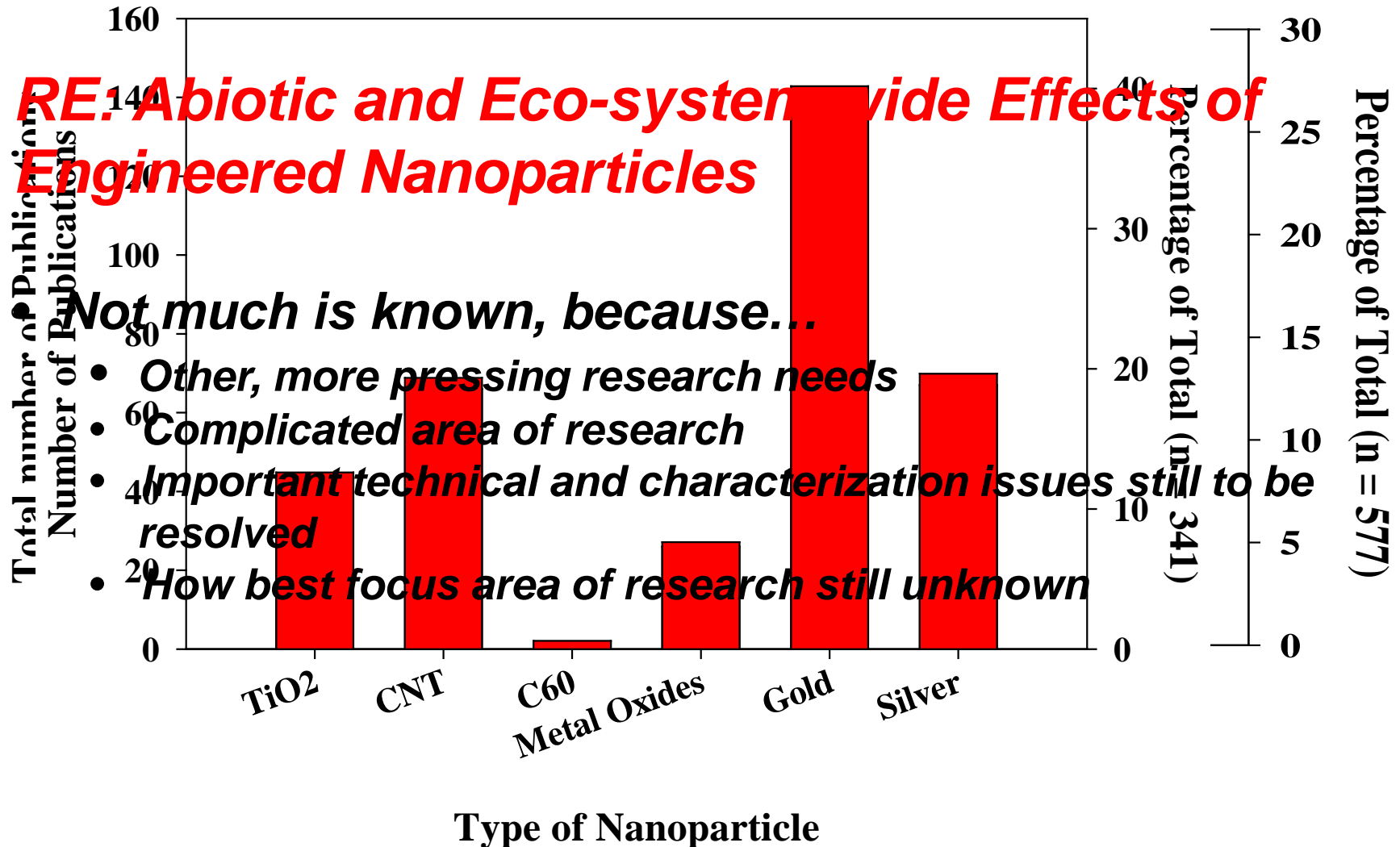


## Aggregation



# 1. Current State of Research?

## ISI Web of Science – Keywords: Nanoparticle Exposure



## 2. Are NNI research needs complete?

***Evaluate abiotic and ecosystem wide effects  
of engineered nanoparticles***

**Need #5**

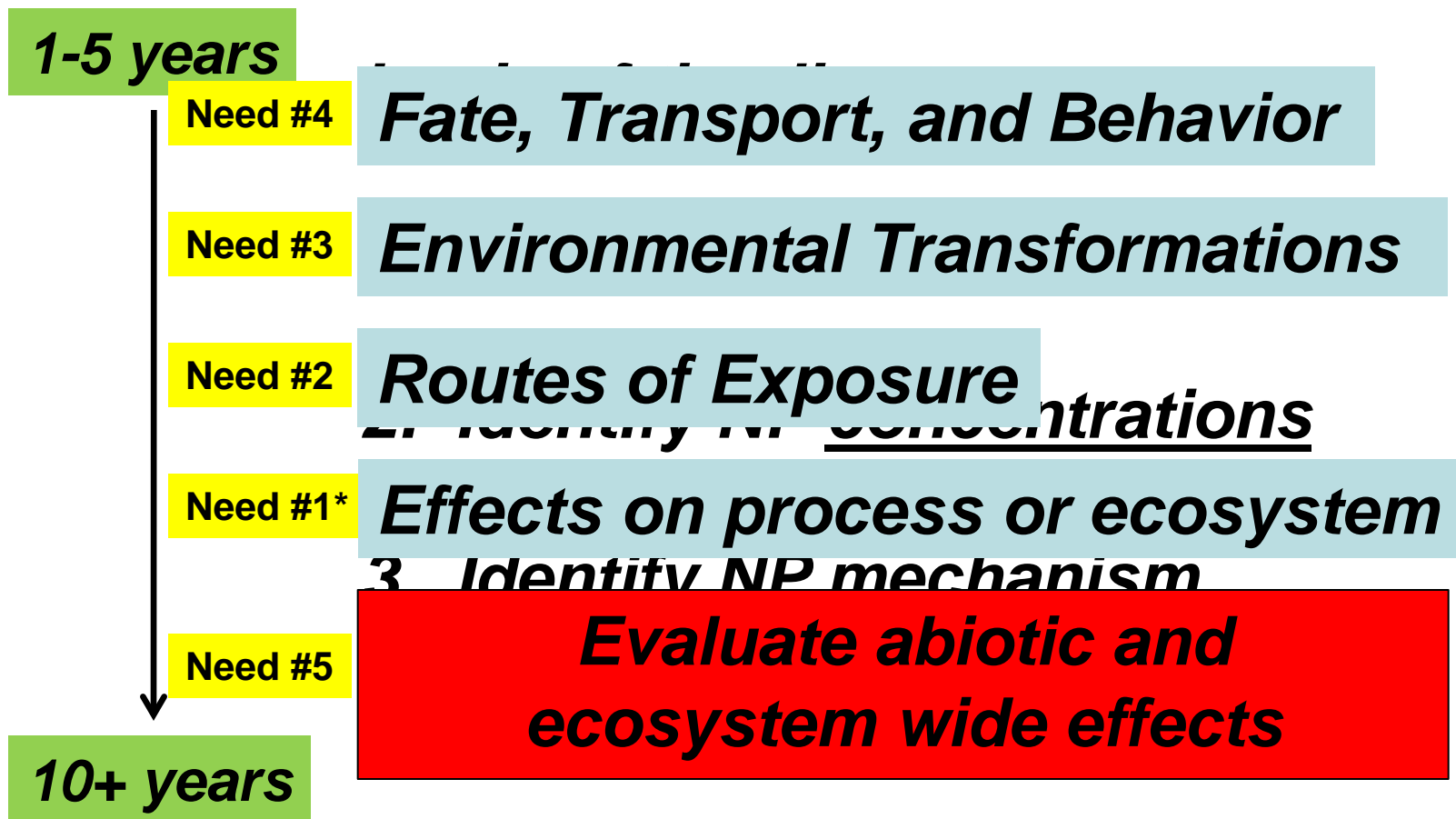
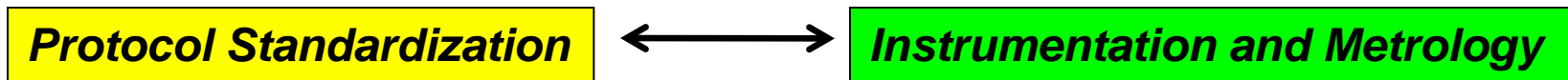
***Dose***

***Response***

***Instrumentation and Metrology***

***Protocol Standardization***

# 3. Research Timeline?



## So little time, so many nanoparticles...





- **Are all our careful measurements useful in predicting, for example, NP behavior or bioavailability in aquatic systems?**
- **Develop NP “Utility Assay”**
  - **Similar is utility to Biological Oxygen Demand (BOD) or Chemical Oxygen Demand (COD) in wastewater**
    - Cheap, easy and routine
    - Provides baseline information
    - Standardized protocol available



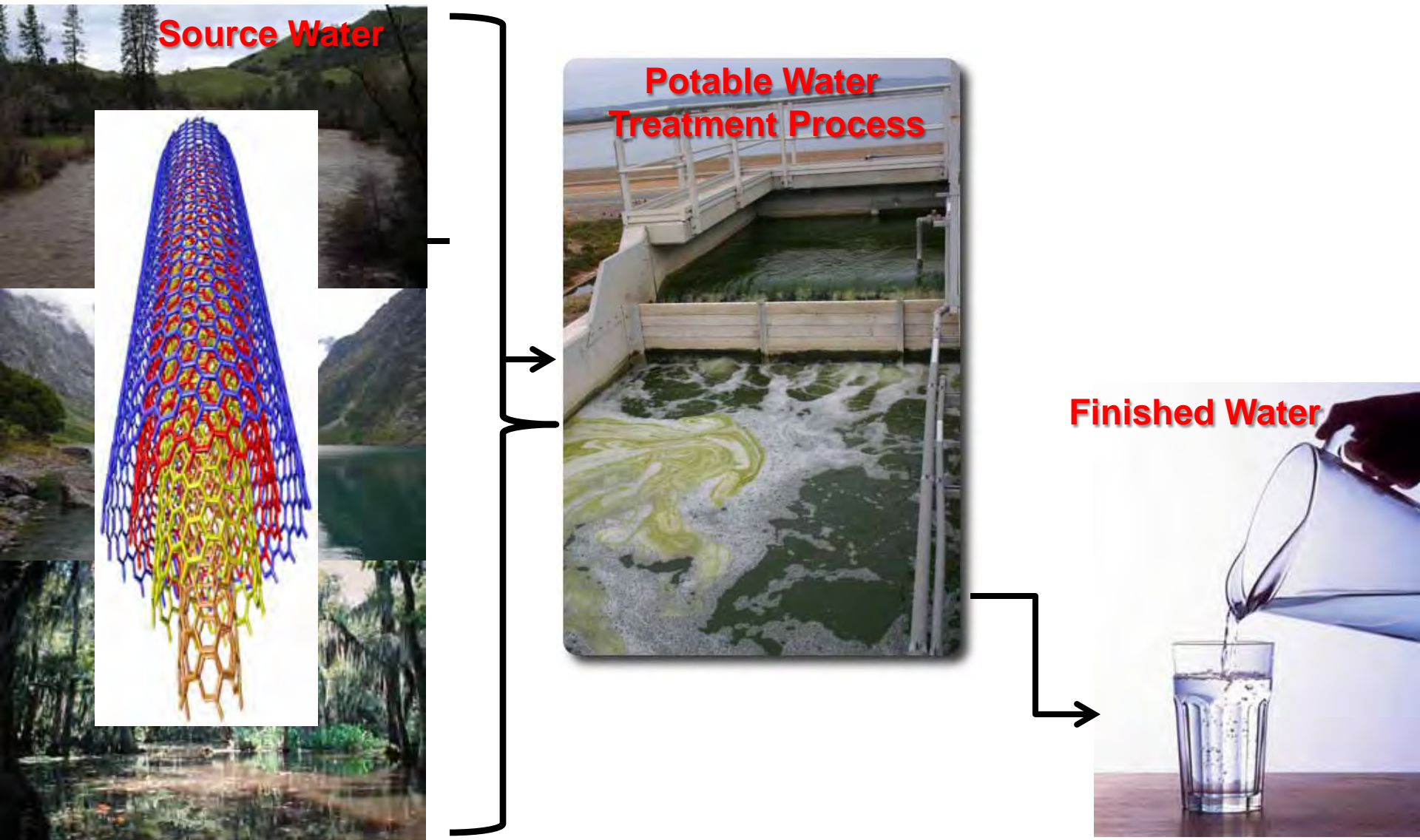


- **Useful Information**
  - Persistence
  - Toxicity
  - Transformations
  - Phase Distribution

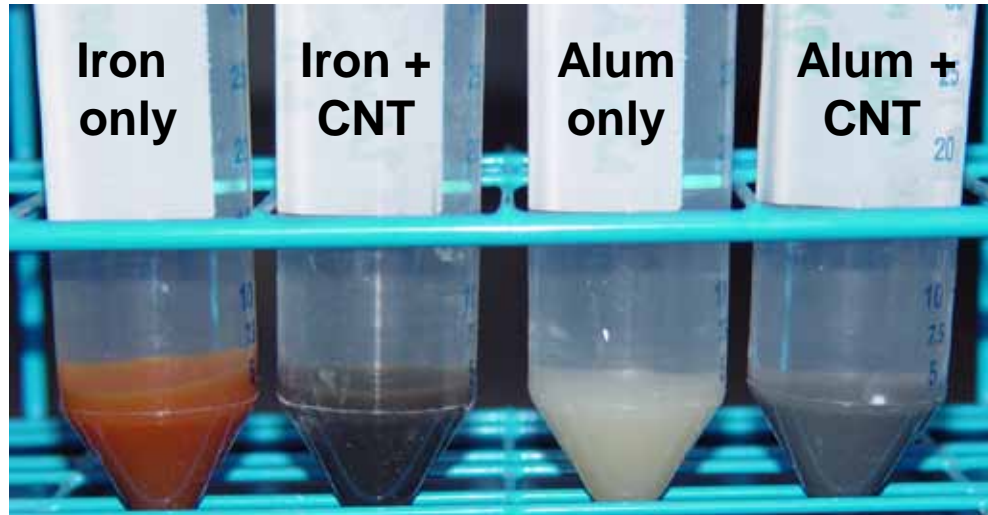
***Ultimate goal – Know what types of NPs require further (more advanced) testing (Worldwide Database).***

***Could provide early information for potential re-engineering of NPs used for specific application.***

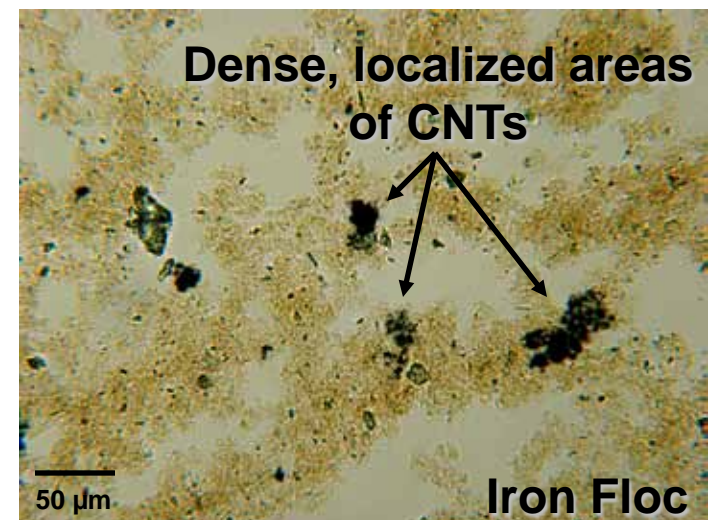
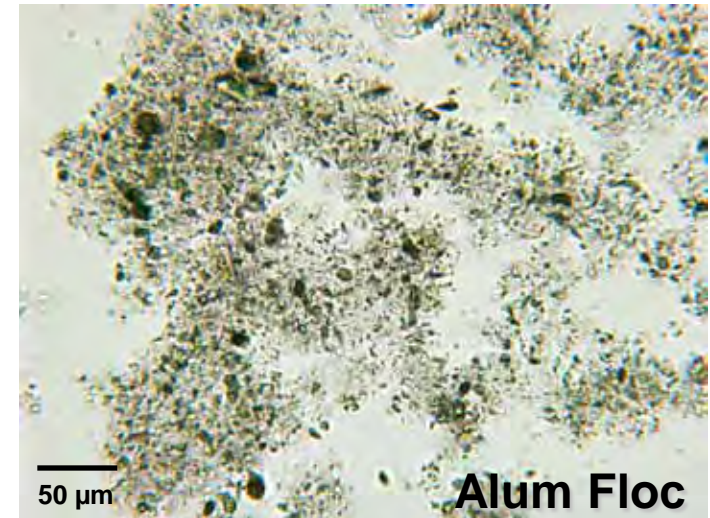
# MWCNT coagulation



# MWCNT coagulation

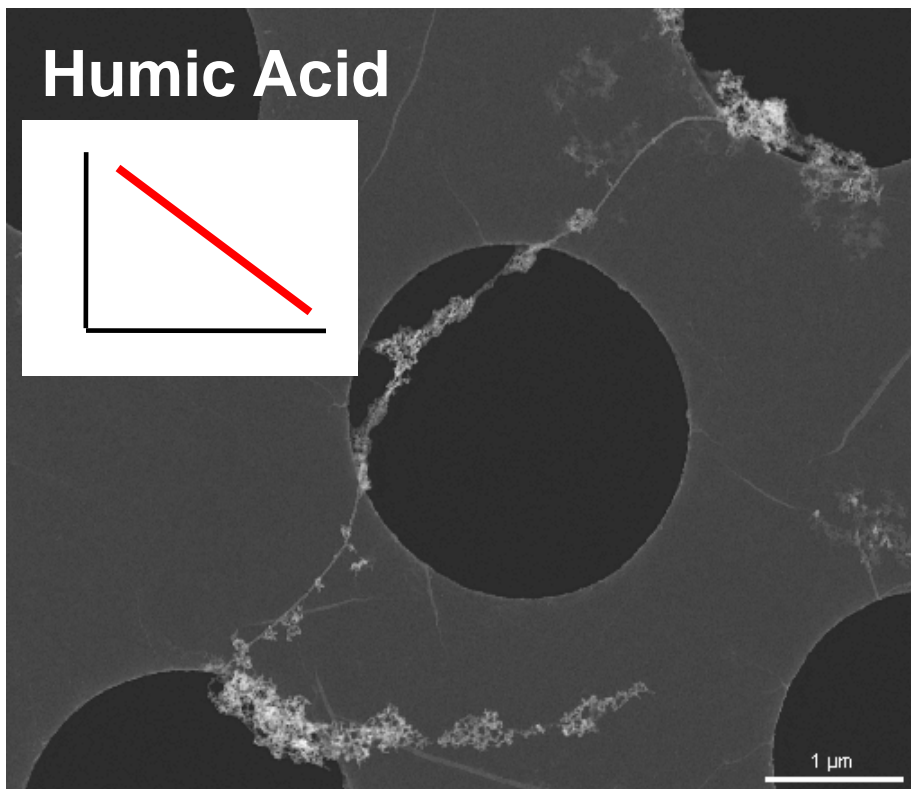
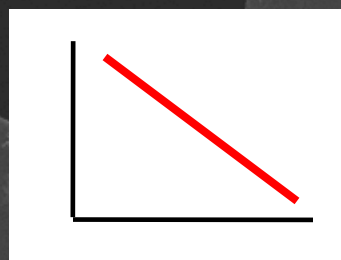


- Settled solids (floc) confirm presence of CNT
- Iron flocs contained localized areas of CNTs whereas alum flocs did not

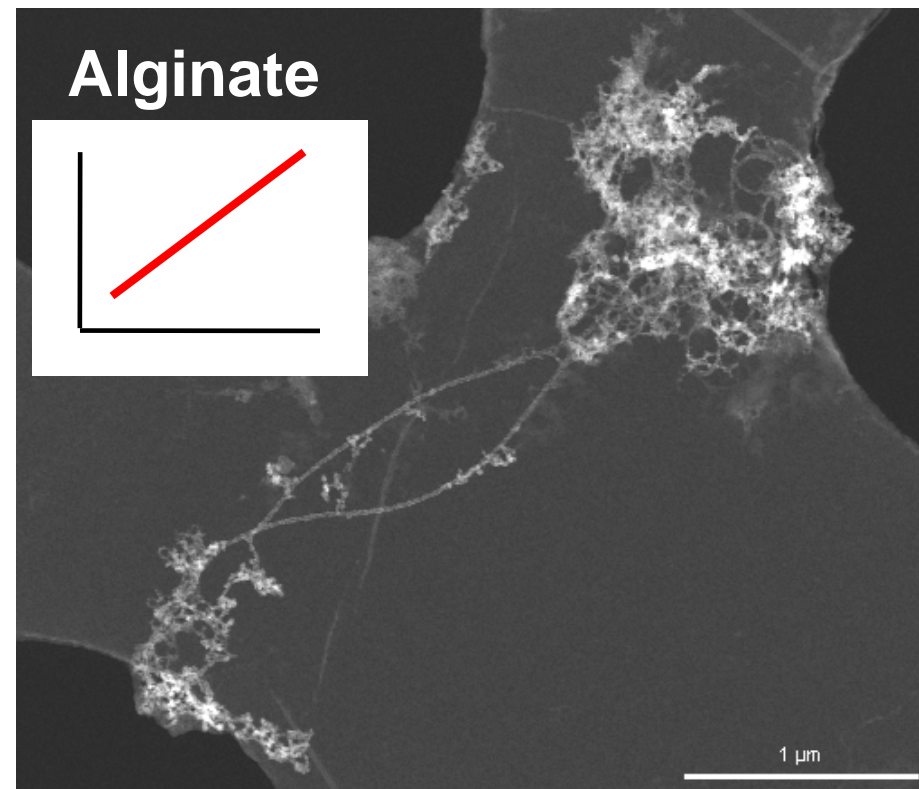
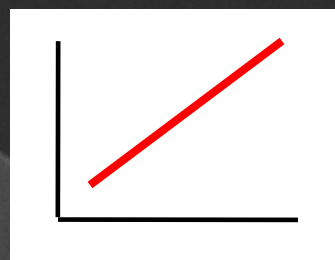


# MWCNT coagulation

## Humic Acid



## Alginate



**MWCNT removal is source water dependent.**

## Questions?

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