Toxicity of Ag to aquatic plants drives Ag fate

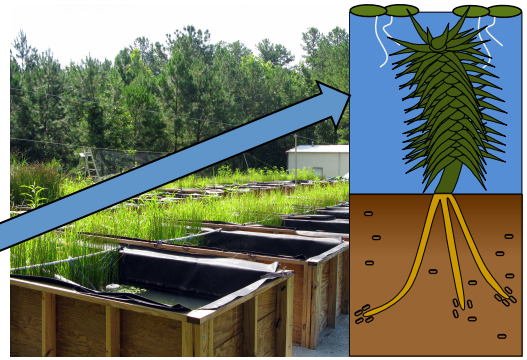
Benjamin P. Colman[1], Curtis J. Richardson[2], Emily S. Bernhardt[1]

Ag added to aquatic ecosystems

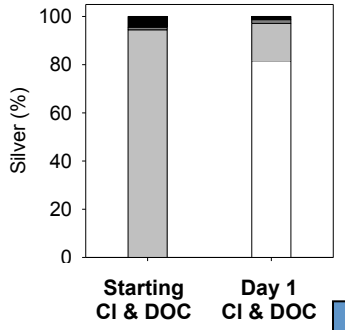
Prediction:
Stability
&
Toxicity

Ag^+ > ● > ○

$AgNO_3$ 12 nm 49 nm
AgNPs

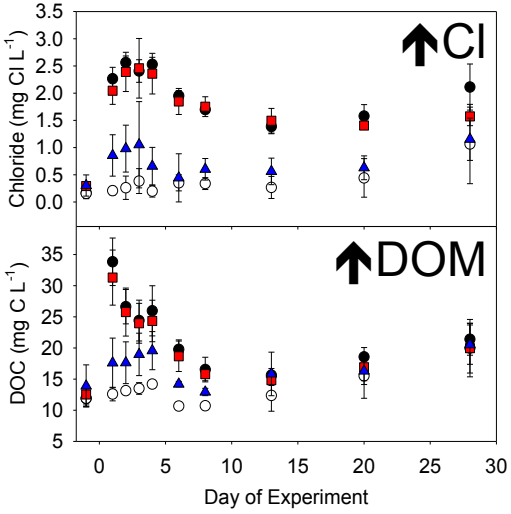


Changing water chemistry decreases Ag^+ solubility in $AgNO_3$ treatment



Speciation model consistent with large loss of Ag in $AgNO_3$ between days 0 and 1 (see below)

Toxicity to plants changes water chemistry



Increased DOC and Cl^- result from Ag toxicity to plants

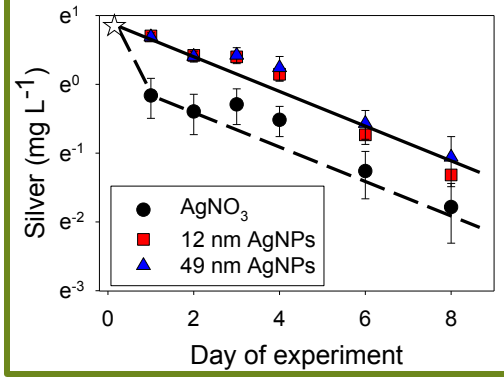
Observation:
Toxicity

Ag^+ = ● > ○

Kinetics equivalent after day 1

1st order rate law: $[Ag]_t = [Ag]_0 * e^{-kt}$

where: $[Ag]_t$ and $[Ag]_0$ – [Ag] at time t and initial
k – rate constant



Observation:
Stability
k (rate constant)

Ag^+ = ● = ○

$k = 0.21 \pm 0.066\ day^{-1}$
Suggests similar removal mechanism In all Ag treatments

Colman *et al.* 2014 *ES&T*

[1]Biology, Duke University, [2]Nicholas School, Duke University

DBI-1266252
EF-0830093

CENT