Supporting Information

CORRELATION EQUATION FOR PREDICTING ATTACHMENT EFFICIENCY (α) OF ORGANIC MATTER-COLLOID COMPLEXES IN UNSATURATED POROUS MEDIA

Verónica L. Morales[a,b], *Wenjng Sang*[a,c], *Daniel R. Fuka*[a], *Leonard W. Lion*[d], *Bin Gao*[e], *Tammo S. Steenhuis*[a*]

[a] Biological and Environmental Engineering, Cornell University, Ithaca, NY 14853 U.S.A.

[b] Curerntly: SIMBIOS Centre, University of Abertay Dundee, Dundee, DD1 1HG Scotland.

[c] College of Environmental Science and Engineering, Tongji University, Shanghai 200092 China,

[d] School of Civil and Environmental Engineering, Cornell University, Ithaca, NY 14853 U.S.A.

[e] Agricultural and Biological Engineering, University of Florida, Gainesville, FL 32611 U.S.A.

5 Pages, 2 Figures

Environmental Science & Technology

Electrolyte Indifference Test

Salting out experiments of dissolved organic matter by NaCl and $CaCl_2$ electrolytes at various concentrations and solution pH were conducted to test the affinity of electrolytes toward dissolved organic matter (i.e., classify the electrolytes as indifferent or non-indifferent). Briefly, 30mL solutions of Elliott Soil HA and FA (obtained from IHSS) at 20 mg of total dissolved organic carbon L^{-1} (measured by persulfate oxidation with an O-I-Analytical Total Organic Carbon Analyzer model 1010, College Station, TX) were prepared and adjusted to solution pH of 4, 5, 6, 7, 8, and 9 by addition of HCl or NaOH as well as ionic strength from 0-12mM by addition of NaCl for the first set and $CaCl_2$ for the second set. After thorough mixing with a vortex, the solutions were allowed to quiescently settle for 24 hours, after which an aliquot was collected and the dissolved organic concentration measured again.

The equilibrium dissolved HA concentrations after 24 hours of quiescent settling (Figure S.1a and b) demonstrate that the addition of $CaCl_2$ precipitates dissolved HA (possibly through complexation of metal cations, Ca^{2+}, with organic matter ligands, HA), while NaCl does not observably affect its solubility. Furthermore, these data demonstrate that pH plays an important role in the threshold calcium concentration at which HA becomes insoluble. Figure S.1a illustrates how, for solution pH levels 7-9, the concentration of soluble HA sharply drops to less than 13% the initial concentration when the ionic strength (by addition of $CaCl_2$) exceeds 2.25 mM. In contrast, for solution pH levels 4-6, the solubility of HA is more gradually reduced and reaches 18% the initial concentration at ionic strength levels exceeding 7.5 mM (by addition of $CaCl_2$). Figure S.1b illustrates that the solubility of HA does not change with the tested ionic strengths 0-12 mM by addition of NaCl at any pH level. This test confirms that while NaCl is an indifferent electrolyte in organic matter rich systems, $CaCl_2$ is not indifferent.

The equilibrium dissolved FA concentrations after 24 hours of quiescent settling demonstrate that unlike HA, FA is insensitive to changes in ionic strengths by addition of $CaCl_2$ or NaCl as per Figures S.2 a and b, respectively.

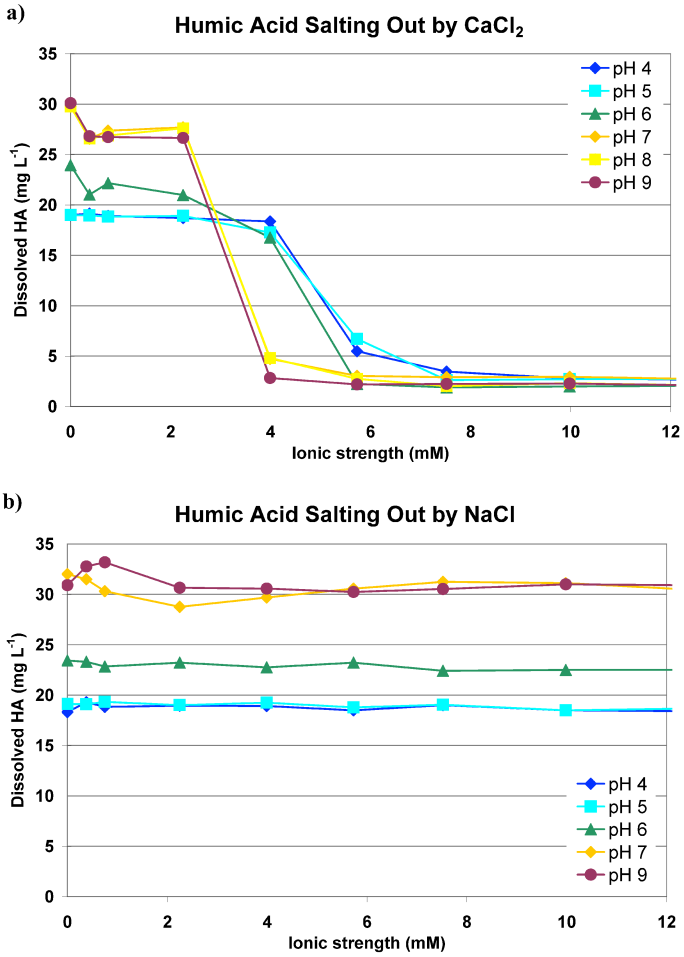

Figure S.1 Concentration of dissolved ESHA after 24 hr of quiescent salting out by addition of a) $CaCl_2$ and b) NaCl at equivalent ionic strengths.

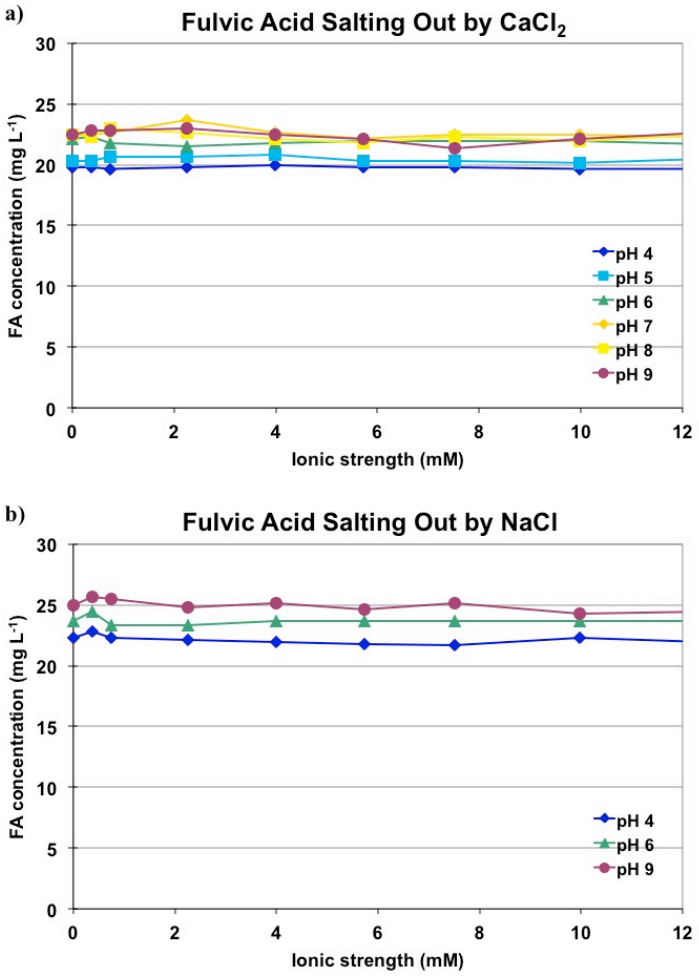

Figure S.2 Concentration of dissolved ESFA after 24 hr of quiescent salting out by addition of a) $CaCl_2$ and b) NaCl at equivalent ionic strengths.