Supplemental Information

Adsorption of PFOA at the Air-Water Interface during Transport in Unsaturated Porous Media

Ying Lyu[1-3], Mark L Brusseau[3,4,*], Wei Chen[3], Ni Yan[3,4], Xiaori Fu[3], and Xueyu Lin [1, 2]

1. Institute of Water Resources and Environment, Jilin University, Changchun, 130026, P.R. China.
2. College of Construction Engineering, Jilin University, Changchun, 130026, P.R. China
3. Soil, Water and Environmental Science Department
4. Hydrology and Atmospheric Sciences Department
School of Earth and Environmental Sciences
429 Shantz Bldg
University of Arizona

Published in:

Environmental Science & Technology

Original Version Submitted in October 2017
Accepted in June 2018

*corresponding author
brusseau@email.arizona.edu

Additional supporting information:

3 Figures

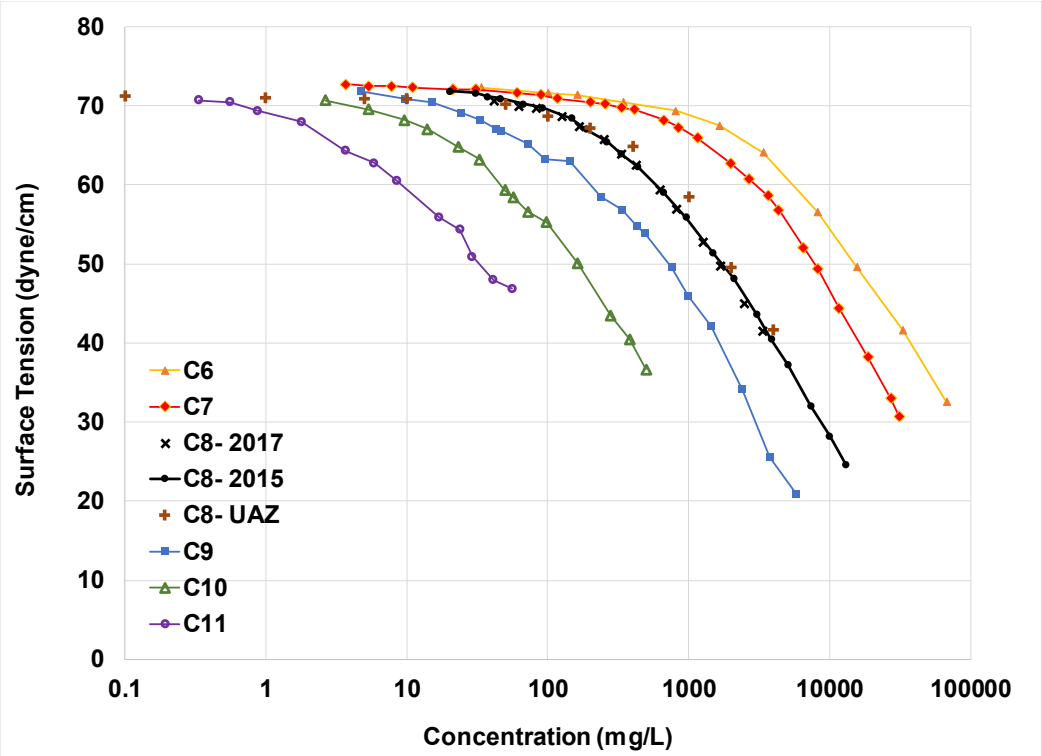

Figure S1. Surface tensions measured for a homologous series of sodium perfluoroalkyl carboxylates in DI water. All data reproduced from Lunkenheimer et al., (2015), except for C8-2017 (Lunkenheimer et al., 2017) and C8-UAZ (measured in this work). C6 = Perfluorohexanoate, C7 = Perfluoroheptanoate, C8 = perfluorooctanoate, C9 = Perfluorononanoate, C10 = Perfluorodecanoate, and C11 = Perfluoroundecanoate.

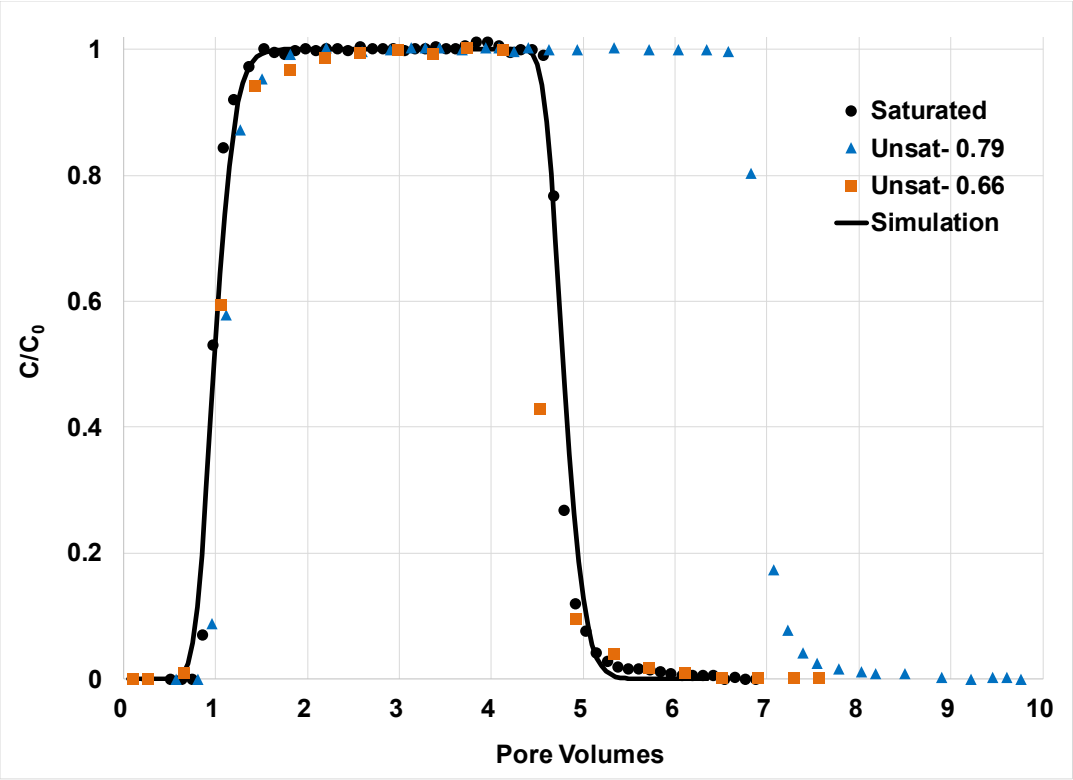

Figure S2. Breakthrough curves for transport of a nonreactive tracer (pentafluorobenzoic acid) through columns packed with a 0.35-mm sand. Numbers 0.79 and 0.66 represent water saturations for the unsaturated-flow experiments. The arrival wave extends longer for the 0.79 experiment because a larger input pulse was used. The model simulation is obtained using the ideal, one-dimensional advective-dispersive transport equation, with R (Retardation Factor) = 1 and Peclet Number = 65. Peclet Number is defined as vL/D, with v = mean pore-water velocity, L = system length, and D = hydrodynamic dispersion coefficient. An analytical solution derived by Brenner (1962) was used to solve the transport equation.

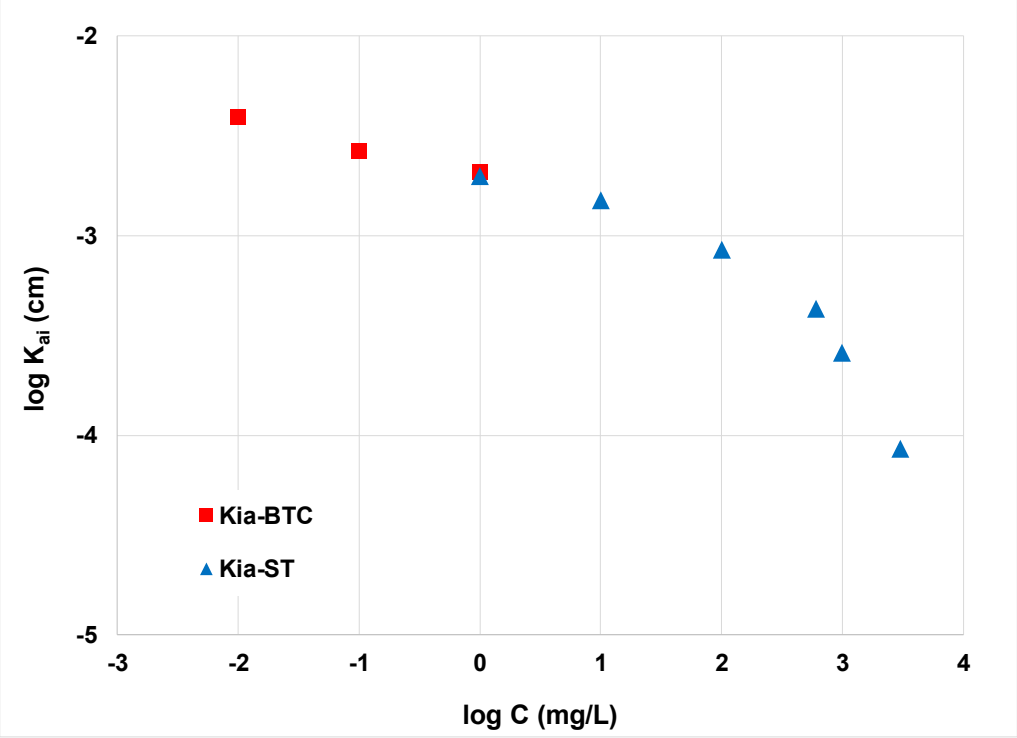

Figure S3. Air-water adsorption coefficient (K_{ai}) as a function of PFOA concentration. Label "BTC" represents data obtained from the miscible-displacement experiments; label "ST" represents data obtained from surface-tension measurements.

References

Brenner, H. 1962. The diffusion model of longitudinal mixing in beds of finite length, numerical values. Chem. Engin. Sci., 17, 229-243.

Lunkenheimer, K., Prescher, D., Hirte, R., Geggel, K. 2015. Adsorption properties of surface chemically pure sodium perfluoro-n-alkanoates at the air/water interface: counterion effects within homologous series of 1:1 ionic surfactants. Langmuir 31, 970-981.

Lunkenheimer, K., Geggel, K., and Prescher, D. 2017. Role of counterion in the adsorption behavior of 1:1 ionic surfactants at fluid interfaces-- Adsorption properties of alkali perfluoro-n-octanoates at the air/water interface. Langmuir 33, 10216−10224.