Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Transport and Aggregation of Nanoparticles in Packed Beds: Effects of Pore Velocity and Initially-Fed Particle Size on Transient Particle Size Distributions NGOC PHAM, DIMITRIOS PAPAVASSILIOU, The University of Oklahoma — Aggregation of colloidal particles in flow through porous media has received careful consideration, as it reduces particle breakthrough due to pore clogging and sedimentation. Additionally, in unstable colloidal systems, deposition of colloidal aggregates on the pore surfaces can create sub-surfaces for further colloidal attachment. This phenomenon is known as ripening effect. In this study, transient particle size distributions of nano-particle systems, propagating in a bed packed with spheres are numerically investigated. In our simulation, only pair interactions are considered, and the aggregation rate is varied with the relative position of two particles in a pair. The packed bed consists of spheres of known size, randomly packed in a simulation box. To generate the velocity field of water inside the porous medium, the lattice Boltzmann method (LBM) is used. In conjunction with that, the trajectories of thousands of massless particles moving with the flow under convection and diffusion are recorded employing a Lagrangian framework [1, 2]. While pore clogging is neglected, we draw attention to the change of the distribution of particle size under different pore velocities and different initially-fed particle sizes.

[1] R. S. Voronov, S. VanGordon, V. I. Sikavitsas, and D. V. Papavassiliou, International Journal for Numerical Methods in Fluids, 67, 501-517, 2011
[2] N.H. Pham, D.P. Swatske, J.H. Harwell, B-J Shiau, D.V. Papavassiliou, International Journal of Heat & Mass Transfer, 72, 319-328, 2014

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Date submitted: 31 Jul 2015 Electronic form version 1.4