In Situ Measurement of the Fractal Dimension of Colloid Deposits in Porous Media

David C. Mays*[1], Orion T. Cannon[1], Adam W. Kanold[1,2], Kevin J. Harris[3], Tim C. Lei[3], and Benjamin Gilbert[4]
Department of Civil Engineering, University of Colorado Denver

Abstract. Clogging, defined as a reduction of permeability, is a major challenge in aquifer and reservoir hydraulics, subsurface remediation, and granular media filtration. Clogging in these porous media results from several mechanisms, including the deposition of colloids. Previous work suggests that clogging by colloid deposition depends not only on the quantity of colloids, but also on their structure. This presentation reports proof-of-principle results showing that it is possible to use static light scattering (SLS) in index-matched porous media to measure deposit structure in situ, by characterizing the dendritic structure of colloid deposits as a fractal dimension. The feasibility of the proposed technique is demonstrated by comparison of the SLS data acquired from stable and unstable colloids in ordinary suspensions and within the index-matched porous medium. These results establish a foundation for future efforts to investigate a possible quantitative link between physical and chemical conditions, colloid deposit structure, clogging, and consequent effects on flow and transport in porous media.

[1]University of Colorado Denver, Department of Civil Engineering, Campus Box 113, PO Box 173364, Denver, CO 80217-3364
[2]Now at Tetra Tech, 301 Mentor Drive, Suite A, Santa Barbara, CA 93110
[3]University of Colorado Denver, Department of Electrical Engineering, Campus Box 110, PO Box 173364, Denver, CO 80217-3364
[4]Lawrence Berkeley National Laboratory, Earth Sciences Division, Mail Stop 90-1116, 1 Cyclotron Road, Berkeley, CA 94720
*corresponding author, david.mays@ucdenver.edu, phone 303-352-3933