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Micromodel study of colloid interfacial retention with application to colloid transport in unsaturated porous media

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Colloid and colloid-facilitated contaminant transport in soil is an important issue in preventing soil and surface and ground water quality. The presence of air in variably saturated soil media results in a number of complicated mechanisms of colloid interfacial retention, which are not well understood. The focus of the present research is the investigation of mechanisms of colloid retention on the air-water interface and air-water-solid interface at the pore scale. Water movement in unsaturated angular capillaries in soil was simulated with a glass square-channel micromodel. The suspension of colloids (fluorescent latex microspheres) was pumped through the micromodel with a syringe pump and the system was visualized with a laser scanning confocal microscope. The observed confocal images demonstrated the accumulation of colloids on the air-water and air-water-solid interfaces. The colloids were accumulated on the air-water-solid interface irreversibly and could be removed only with additional treatments. The micromodel experiments emphasize the interplay of physicochemical and hydrodynamic parameters in the interfacial regions. In this presentation, we will discuss the effects of flow velocity, ionic strength, and concentration of colloid suspension on colloid interfacial retention in variably saturated media based on confocal observations from a series of unsaturated micromodel experiments.