Contribution ID: **654** Type: **Oral Presentation**

Saturated Colloid transport experiments under unfavorable conditions in Dual-Porosity PDMS micro-models.

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Increased use of natural and engineered colloids and nanoparticles in agriculture, industry, and consumer products leads to more exposure of these particles to soils. Transport of particles through the subsurface attracted attention since they are being detected in the environment in larger amount and also in our nation drinking water supplies which can pose health threat. Preferential flow caused by aggregated soil profiles, or porous media that are structured, fractured, or microporous in other ways can be a mayor contributor to surface and subsurface pollution problems.

In this study we manufactured PDMS micromodels based on x-ray tomography and transformed solid grains into aggregates. We replaced 25, 50, 75, and 100% of the solid grains into aggregates. The models have distinct inter-aggregate and intra-aggregate pores. We explored colloid transport under unfavorable conditions by improving three major shortcomings: domain size, imaging resolution and frame rate. We have developed an optic set-up allowing for imaging with a high resolution of 2.9 µm, applying large micromodel with length and width of 10 millimeter with unstructured design, and a frame rate of 10 frames per second. We have captured the full trajectory of a large number of colloids flowing through pore structures at the same time and capturing their dynamics under unfavorable conditions in the presence of a high energy barrier. Streamline of each colloid within the domain was obtained and further divided into three categories of fully mobile, full attached, and remobilized particles which were analyzed in detail. We have used 4 micrometer colloids and applied an average velocity of 50 cm/hr.

During all experiments over 1500 colloid trajectories were observed. While chemical conditions is unchanged between the samples a high increase from almost 0 % with no aggregates present to 40% of colloid retention with 100% of aggregates. Remobilization events were rare in all models. The trajectory tortuosity decreased from 1.21 to 1.15 due to the increased amount of aggregates leading to shorter flow paths. By introducing aggregates there is a much higher chance for colloids to be transported through the intra-aggregate pores leading into a higher chance for the colloid to interact with a collector surface and attach, adding as well the lower flow velocities inside them attribute to attachment.

Time Block Preference

Time Block B (14:00-17:00 CET)

References

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Student Poster Award

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