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Investigation of Nanogel Transport in Porous Media by Microfluidic Models

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Polymer nanogels, crosslinked polymer particles, have attracted increasing interest in Enhanced Oil Recovery (EOR) field. However, it is still unclear that how to properly utilize nanogels to reach their full potential in oilfields because the transport mechanisms of nanogels in porous media are not well understood so far. In this work, we synthesized a fluorescent nanogel and visualized the transport and retention of fluorescent nanogel in 3D transparent glass micromodels that are manufactured by packing glass beads in capillaries. Finding the relationship between fluorescent intensity and nanogel concentration, we quantified transport velocity, concentration distribution and corresponding pressure gradient by confocal microscopy.
It was found that in a micromodel with a permeability of around 6 Darcy, these elastic polymer particles could transport at a pressure gradient of about 2 psi/ft. Besides, we proposed a new method to calculate dynamic adsorption of nanogel in porous media and showed the influence of flow rate on adsorption thickness. The results showed that the adsorption decreased with increasing flow rate and the adsorption density was about 6mg/g with the adsorption thickness of 1-2μm. We also found that the transport of polymer nanogels followed convection diffusion equation very well. This research improved the understanding of polymer particle transport in porous media and provided a novel method to obtain the kinetics of dynamic adsorption.

Participation

In-Person

References

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Primary authors: Prof. BAI, Baojun (Missouri University of Science and Technology); Mr LIU, Junchen (Missouri University of Science and Technology); Prof. WANG, Yangling (China Univeristy of Petroleum)

Presenter: Prof. BAI, Baojun (Missouri University of Science and Technology)

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