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Effect of long-range electrostatic interaction on pore clogging in viscous particle flow[1] SHENG CHEN, MENGMENG YANG, SHUIQING LI, Tsinghua Univ — In this study, we implement the long-range electrostatic interactions (both Coulomb and dipole interactions) into the discrete-element method simulation of small adhesive particles to investigate their influence on the formation of clogging patterns at single-pore level. The relationship between microscopic interparticle forces and the macroscopic clogging quantities, i.e. the flow permeability and clogging structures, is established. Simulated results indicate that the early-stage capture of charged particles is enhanced by the attraction between these particles and their induced charge on the wall surface. However, further aggregation is suppressed by the repulsive Coulomb interaction between the deposited particles and the suspended ones. Meanwhile, the attraction among polarized particles causes the formation of long particle chains on the surface. These particles chains, bended by flow stress, enhance the bridging phenomenon that leads to a rapid pore clogging. Comparatively, the final clogging structures have lower volume fraction and higher flow permeability in contrast to the neutral case. The results suggest that the controlled charging or polarizing of particles provide a feasible way to tune the formation process and the final state of pore clogging.

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