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Effect of adhesion on particle clogging in fiber filtration RAN TAO, SHUIQING LI, MENGMENG YANG, Tsinghua University — A new multi-time step approach combining a discrete element method with computational fluid dynamics is developed to investigate the clogging phenomenon in two-fiber filtration system of micro-particles. A dimensionless adhesion parameter, Ad, is introduced to characterize clogging of particles during the filtration, while the Stokes number and the interception parameter are kept constant. The results indicate that, in the adhesion-dominated regime, clogging definitely happens at Ad=16 or larger, which identifies two distinct zones of unclogging and clogging. Particularly, we find a best clogging range of Ad=18 to 36 with much shorter clogging time and fewer particles penetrating through. According to the morphological characteristics of deposited particle chains, the clogging time can be further decomposed into chain growing time and bridging time. Despite the shorter bridging time under larger Ad cases, we demonstrate that the delay of clogging can be solely attributed to the increasing chain growing time. This finding highlights that the short-range van der Waals adhesion plays a crucial part during particle clogging process, and is believed to be helpful for the understanding of filtration.

Ran Tao
Tsinghua University

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