TWO-DROP GAS-LIQUID COALESCENCE FILTRATION MODEL AND COALESCENCE MECHANISM

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In the coalescence filtration test, a unique trend of filter saturation is observed that the filter exhibits larger saturation values at front and end edges showing a valley point in the middle. This 'U' shape trend is universal in different experiments as long as the medium has certain thickness with uniform physical properties. Interpreting this unique trend can help us have a better understanding of coalescence filtration process. It is not only because saturation of filter medium strongly impacts filtration efficiency and pressure drop, but also saturation can be evaluated at different position inside medium. To interpret this saturation trend, we need to explore both the coalescence mechanism in bulk region and capillary effect acting on the edges. In this work, a one-dimensional mesoscale two drop model is introduced. Especially, the exploration of coalescence mechanisms is focused. The novelty of this model is the importation of two size drops, which rationally disassembles the complex coalescence process into two parts with sound assumptions. One size drop d1is very tiny and stationary once it is captured by fibers. The other size drop d2 is coalesced drop which is large enough to move through the medium. This multiphase system is composited of gas, liquid and solid phase. The gas phase contains air and d1 drops. The liquid phase consists of two species both d1 and d2 drops. The sets of governing equations describing the multiphase system are defined by the conservation of mass, species and momentum equation of state. Saturation as a function of position is desired to be predicted and validated by virtue of experimental measurements. The predicted results are validated with experimental data. A genetic algorithm method is applied on parameters fitness.