Abstract Submitted
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The porous medium permeability and effective diffusion coefficient direct correlation BOJAN MARKICEVIC, Pall Corp, Cortland, NY — Dimensionless analysis of a momentum and mass transport in the homogeneous porous medium reveals that the permeability and effective to the molecular diffusion coefficient ratio can be expressed as a function of medium pore and throat sizes and two additional geometrical scales. These two scales, each one pertinent to the momentum and mass transport, respectively, are referred to as permeability and diffusivity characteristic scales. Based on these findings, it can be shown that the medium permeability and effective diffusivity can be correlated, and, at the same time, that one microscopic scale needs to be known in this correlation. The same is implied from the Katz-Thompson formula - which correlates the permeability, effective diffusivity, and breakthrough capillary pressure length scale. We recast the correlation developed into the Katz-Thompson formula form, showing how corresponding members are related. It turns out that the coefficient from the Katz-Thompson formula is equal to the ratio of the permeability to diffusivity characteristic length scales, and it is indeed constant for the homogeneous media. As porous media are heterogeneous materials, the analysis is extended onto such materials using heterogeneous capillary networks. The networks with the uniform, normal and *log*-normal pore size distribution functions are generated, where the networks are sufficiently large to obtain small variations in permeability and effective diffusivity for pore size distribution set. For such stochastically homogeneous media, the effective pore size averages are used in calculating the permeability and effective diffusivity showing the true nature of the coefficient in the Katz-Thompson formula.

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