IMPROVED MODELING OF FILTER EFFICIENCY IN LIFE-TIME SIMULATIONS ON FIBROUS FILTER MEDIA

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ABSTRACT

A general recent trend in determining the quality of filter media and filters lies in counting particles rather than weighing the media or filter. By using counters before and after the filtration – as in the standardized multi pass test - the filter efficiency can be determined in a detailed way by listing the quotient of captured over total particles as a function of particle diameters. This measure can also be simulated on detailed models of fibrous filter media with GeoDict.

In this work, we report on multi pass test results for an oil filter media exhibiting a non-intuitive filtration behavior. After an initial rise, the fractional filtration efficiencies decrease again, until the filter material is clogged. To understand the cause for these experimental findings, fractional efficiencies are determined numerically taking into account a possible re-entrainment of particles.

To achieve statistically reliable efficiency results, a large number of particles must be considered. Filter loading experiments are carried out on at least a few square centimeters of media. Even for those, the statistics of particle counting for large particles usually rely on very few particles. Media scale simulations, on the other hand, consider even smaller surfaces of about a square millimeter. For these smaller surface areas, arrivals of large particles are even less probable than in experiments and the predicted filter efficiency curves would have low statistical relevance. By interspersing filter efficiency simulations with many more particles than would actually arrive at the media during life time simulations, the quality of the filtration statistics of media scale simulations can be improved such that a quantitative comparison with experimental data becomes possible.

KEYWORDS

Media Scale Simulations, Filter Efficiency, Life Time, GeoDict, Filtration Modeling