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A model for steady-state liquid transport and saturation in a coalescence filter

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This presentation deals with the functioning of coalescence filters typically used to remove small liquid droplets from an aerosol, for instance generated by automotive crankcase veantilation (oil mist) or industrial processes (acid mist). In principle, such mistfilters become entrained with liquid in the early stages of operation, until they reach a stationary state where accumulation rate equals entrainment and drainage rates.

A kinetic model has been developed to describe the spatial distribution of liquid within the filter in terms of a steady-state saturation $S(x)$, where x is the the filter depth in flow direction. The model is based on a balance of liquid accumulation and transport rates within an infinitesimal layer. The solution of the resulting differential equation is in good agreement with U profile for $S(x)$ obtained by experiment (figure).

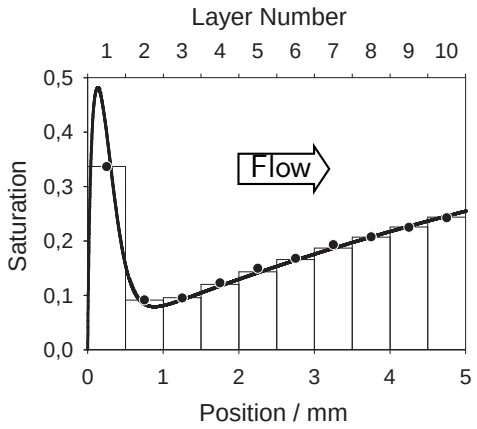

Figure: The experimental saturation profile (circles), measured by determining the average layer saturation of a coalescence filter for oil mist consisting of 10 layers is in good agreement with the model (line and resulting average layer saturation as bar chart).