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COALESCING FILTER MODEL FOR GAS CLEANING APPLICATIONS

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Abstract

Pure air/gas is very critical to many industrial applications. Gas streams contain impurities in the form of solid and liquid aerosols in micron and submicron sizes. It is very important to remove these aerosols for protecting our health and environment, improving the reliability of industrial processes and equipments. Among different filters being used, fibrous filters are very effective in removing aerosols in micron-submicron sizes. Important applications include compressed gas cleaning, CCV, HVAC, refineries, breathing apparatus etc. To remove liquid droplets from a gas stream, fibrous filters act as a coalescing medium where smaller droplets merge to form bigger droplets which eventually drain out of the filter with clean gas going to the downstream process.

The performance of a coalescing filter medium depends on many factors like droplet and fiber size, face velocity, gas and liquid properties, liquid accumulation etc.
The current work aims at developing a model to determine the liquid accumulation which is otherwise referred as the saturation. Higher the saturation at steady state, higher is the pressure drop which will increase the operating cost.

The model takes in to account the dominant mechanisms for drop capture, growth and break-up on the media. The proposed mechanisms are droplets on fibers, droplets on drops, sweep and break-up mechanisms. The model evaluates each mechanism on a step-by-step process and updates the no. of drops of each size with respect to time and position. Total volume of drops at each position is then calculated to determine saturation with time. Using this model, sensitivity of each input parameter towards the final performance can be easily determined. The model results can be used to determine optimum parameter values to achieve higher efficiency with much less pressure drop.

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