THE JUMP & CHANNEL MODEL: EXPLAINING PRESSURE DROP AND EFFICIENCIES OF OIL MIST FILTERS

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The Jump & Channel-Model by Kampa et al. phenomenologically describes the overall pressure drop Δp of a wet oil mist filter as the sum of an internal and an external contribution of Δp. The former is termed the "channel-Δp" while the latter, typically a steep increase of Δp, is called "Δp-jump". The channel-Δp is associated with the formation of distinct oil channels within the media (though which the coalesced oil has to be "pumped"), while the Δp-jump is due to an oil film through which the air flow has to break through. For wettable filter media this film occupies the downstream face of the filter, whereas for non-wettable media it occurs on the front face. Understanding the interactions of multiphase flow in non-woven filter media and its implications for Δp and efficiency is key for further development of improved filters.

Experiments were conducted with flat sheets of 5 commercially available glass fiber media (3 wettable, 2 non-wettable) and are discussed on basis of their corresponding Δp and efficiency data. The operating conditions such as the oil loading rate of the submicron aerosol (15 to 125 mg/(m²s)) and filter face velocity of the air flow (5 to 70 cm/s) show that Δp-jump is determined mostly by the structural properties of the filter media, whereas the amount of liquid determines the contribution of the channel-Δp. The existence of channels and a liquid film can also be seen from the temporal evolution of the efficiency of a glass fiber filter.