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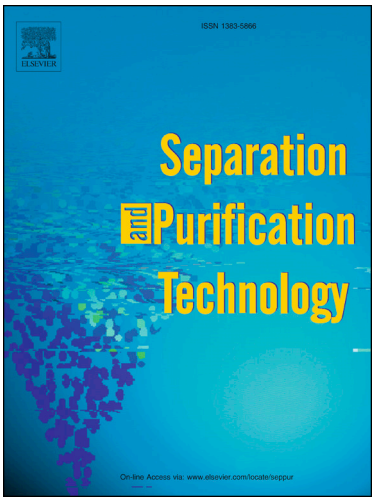


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# Effect of liquid surface tension on the filtration performance of coalescing filters

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**Abstract**

Fibrous coalescing filters are used to collect droplets from air streams and are widely applied in the process industry but liquid surface tension affects the filter performance. In this work, the wet pressure drop, saturation, liquid distribution, and filtration efficiency of both oleophilic and oleophobic filters were investigated using four liquids with different surface tensions but similar densities and viscosities to produce aerosols. The results showed that an increase in surface tension accelerated the evolution of the wet pressure drop of filters. The jump pressure drop increased significantly while the excess channel pressure drop was constant with growing surface tension. The average saturation in the channel layers decreased as the surface tension increased and the decrease rate was much greater in oleophobic than oleophilic filters. The liquid distribution was also influenced by the surface tension. In oleophilic filters, higher surface tension led to a smaller number of channels and a larger size per channel. The channel boundaries were difficult to distinguish when the relative wettability between the liquid and filter media was very high or very low. Both oleophilic and oleophobic filters showed higher filtration efficiency at steady state in both sub-micrometer and micrometer droplet-size ranges when separating liquids with a larger surface tension. Additionally, superoleophilic and superoleophobic filters were prepared through a dip-coating method. When compared with untreated (oleophilic) and superoleophilic filters, the superoleophobic filters had the best overall performance for each liquid type due to the greatly reduced liquid hold-up.

**Keywords:** Coalescence; Liquid aerosols; Filtration; Surface tension; Saturation

## 1. Introduction

Coalescing filters are widely used to remove liquid aerosols consisting of droplets with

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