AEROSOL DROPLET MIGRATION IN DEPTH COALESCING FIBROUS FILTER MEDIA

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Fibrous filters are widely used in the petrochemical industries to separate aerosol droplets from air to protect the environment and worker health. Enhancement of the design, and materials in coalescing filters, lower the operating cost of filtration/separation applications. Also, it improves the workers' health and protects the environment from harmful liquid aerosols produced by gas compression equipment. A vast number of industrial processes apply motion of droplets in fibrous media. Therefore, understanding the mechanisms controlling the movements of drops on fibers and through the media and development of the fundamental theory is needed for the optimized design of coalescing filter media. The performance of a filter medium depends on factors like fiber size, droplet, face velocity, liquid properties, and gas conditions. In the operation of a fibrous filter, the droplets carried by a flowing gas are captured by the filter medium due to collisions with the fibers of the medium. Liquid droplets can deform when forces are applied and, when captured on fibers, the droplets can spread over the fiber surface, coalesce into larger drops, and can migrate within the filter as drops or as a flowing film. This work aims to develop a new generalized theory for the design and manufacture of gas-liquid separation media by developing correlations for gas flow conditions and movements of liquid drops in fibrous media to find the lowest Reynolds number that could initiate the movement of liquid drops in fiber mats. These relationships along with the correlations developed in the literature will enable the design and development of the next generation of fibrous filtration/separation media with superior performance.