347a Improvement of Adsorption Applications Using High Contacting Efficiency Microfibrous Entrapped Materials

Eric A. Luna, Ranjeeth Kalluri, Donald Cahela, and Bruce Tatarchuk

The bulk of current adsorption technologies currently rely on packed bed heterogeneous contacting. Although well developed and largely understood, packed bed performance is limited by the physical relationships between pressure drop, particle size and intraparticle transport. In this work new materials have been specifically created to improve adsorption applications and to overcome the above noted contacting efficiency relationships. These materials (called microfibrous materials) are a composite of bound particulate (10 to 300micron particle size) using a sinter-locked microfibrous carrier. The microfibrous carrier comprises approximately 2 volume percent of the media and can be of micron diameter metal, ceramic, or polymer fibers (ca. 2 to 20micron diameter). The advantages of microfibrous materials over conventional packed beds are high contacting efficiency, low pressure drop, and the flexibility to be tailored to multiple applications and environments. The production of these media is done using high speed and low cost wet-lay processes which facilitate the entrapment of fine particulates. The range of applications to be discussed in this paper includes stand-alone trace contaminant removal, packed bed enhancement, and filtration of a practical reformate stream for PEM fuel cells. When used alone, microfibrous materials have the ability to provide greater than 5-Log filtration in a thin layer (ca. 1mm) until 95 percent of the saturation capacity is attained. These materials can also be combined with conventional packed beds in what is termed a “composite bed.” The composite bed synergistically combines the volume loading of the packed bed sorbent and the overall contacting efficiency of the “polishing sorbent layer,” thereby eliminating the inefficiencies normally associated with the critical bed depth of the larger particle packed bed. These materials have also been used to significantly extend the gas life of packaged gas mask canisters (i.e. 50 LPM with 3000mg/m^3 DMMP) while maintaining greater than 5-Log filtration.