Packing Optimization of Sorbent Bed Containing Dissimilar and Irregular Shaped Media

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The Fire Cartridge is a packed bed air filter with two different and separate layers of media designed to provide respiratory protection from combustion products after a fire event on the International Space Station (ISS). The first layer of media is a carbon monoxide catalyst and the second layer of media is universal carbon. During development of Fire Cartridge prototypes, the two media beds were noticed to have shifted inside the cartridge. The movement of media within the cartridge can cause mixing of the bed layers, air voids, and channeling, which could cause preferential air flow and allow contaminants to pass through without removal. An optimally packed bed mitigates these risks and ensures effective removal of contaminants from the air. In order to optimally pack each layer, vertical, horizontal, and orbital agitations were investigated and a packed bulk density was calculated for each method. Packed bulk density must be calculated for each media type to accommodate variations in particle size, shape, and density. Additionally, the optimal vibration parameters must be re-evaluated for each batch of media due to variations in particle size distribution between batches. For this application it was determined that orbital vibrations achieve an optimal pack density and the two media layers can be packed by the same method. Another finding was media with a larger size distribution of particles achieve an optimal bed pack easier than media with a smaller size distribution of particles.