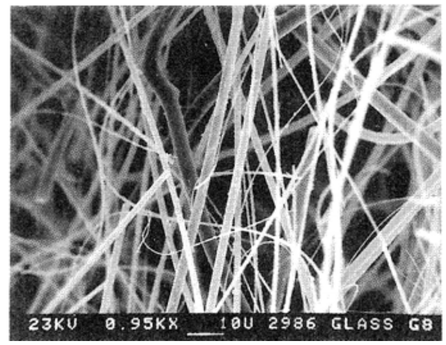
Fact Sheet

Air Filters in Swine Operations

- Air filters in swine operations are made from non-woven fibrous media (see figure). Fibrous filters can be designed and manufactured in different ways to achieve a wide range of ***efficiency*** – the fraction of incoming particles captured by the filter – depending on the requirements of the end users.



- In addition to efficiency, the other important performance parameter for filters used in swine facilities is the ***pressure drop* across** the filter, a reflection of the amount of resistance a filter offers to the air passing through it. Filtration systems are usually optimized to achieve the necessary efficiency at the lowest pressure drop possible.
- Filters collect particles by a variety of mechanisms. Particles are captured by *interception* when they follow air around filter fibers and come into contact with the fiber. Large and heavy particles have inertia and can be collected on fibers by *impaction* like a bug on a windshield. Small and light particles move randomly due to Brownian motion and can be captured by *diffusion* on filter fibers. Some filters are made from fibers that carry electrostatic charges; these charges help to capture airborne particles that naturally carry electrical charge.
- The effectiveness of the interception, impaction, and electrostatic filtration mechanisms increases as particles become larger. However, the diffusion mechanism becomes more effective as particles get smaller. This means that filters typically used in swine facilities will collect the very largest and very smallest particles with high efficiency. The particles that filters collect with the lowest efficiency are usually between 50 and 300 nanometers (0.050-0.3 microns) in size.
- Manufacturers selling ventilation filters measure the efficiency of their filters by running standard tests that produce a Minimum Efficiency Reporting Value, or MERV rating. MERV ratings are tied to a look-up table that tell customers the efficiency of the filters in three different particle size categories ranging from 0.3 to 10 micrometers. Efficiency is higher as the MERV rating increases. Versions of the look-up tables can be found on the web, including in an article by David Matela in HPAC Engineering at http://hpac.com/fastrack/matela-06-08.
- Biological aerosols, or bioaerosols, include airborne viruses and bacteria, as well as airborne fungi, pollen, animal allergens, fecal matter, and dust from animal feed. Viruses and bacteria are almost never separate particles by themselves, they are mixed into other particles that contain dust, fecal matter, saliva, or respiratory fluid. *Filters collect bioaerosol particles just as effectively as non-biological particles of the same size.*
- As filters collect and retain particles, the resistance to air flow increases. This is reflected as increasing pressure drop across the filter over time. When filtration is added to swine buildings, a common practice is to make the buildings more airtight at the same time so that there are fewer openings through which air can bypass the new filters. When pressure drop increases, it is harder to draw air through the filters. Instead, more air will enter the building through the leaks. Swine facilities should have a regular schedule for changing out filters so the pressure drop will not build up too much. Otherwise, the filters will become less effective with time because more and more of the incoming air will bypass the filters.
- Filters carrying electrostatic charge generally have higher efficiency at the same pressure drop or lower pressure drop for the same efficiency relative to filters made from fibers that do not carry charge. However, electrostatically-charged filters lose efficiency with use because captured particles make the charge less effective. On-going research will assess which type of filter is best for filtration systems in swine operations.

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