

biofilters do not increase the spore load of "treated" air under stable conditions and creates only minor increases when subjected to disturbance events.

#### **2D6o5 Temperature and airflow influences indoor air biofiltration**

*DJ Llewellyn, AB Darlington and MA Dixon*

Biofiltration is an alternative to ventilation for maintaining indoor air quality. Our biofilters were comprised of complex communities of plants which provides many ecological niches for microbial colonization while having strong aesthetic appeal. This study focused on the effects of temperature and airflow on biofiltration of volatile organic compounds (VOCs). Indoor biofilters typically function very well at ambient temperatures. However, some poorly degraded VOCs have low solubilities. Reduced biofilter temperatures may improve degradation by increasing contaminant solubility, however this may be offset by reduced microbiological activity. Another advantage of subambient temperatures is a reduction in humidity loading on the indoor air stream. Test biofilters were run at temperatures of 17 and 27 C. Ambient methylethylketone (MEK) and benzene concentrations ranged from 10 to 80 ppbv. Benzene removal was greater at 27 C suggesting microbially limiting conditions while MEK removal was higher at 17 C inferring substrate-limiting conditions.

#### **2D6p1 Acclimation and nutrition of indoor air biofilters**

*AB Darlington and MA Dixon*

Biofilters removed significant amounts of toluene and methylethylketone (MEK) present in parts per billion (by volume) concentrations from an indoor space. Two species of living moss (*Plagiomnium cuspidatum* and *Eurhynchium riparoides*) and coconut fibre were used as packing material. The moss biofilters removed significant amounts of MEK during the first diurnal cycle of operation and required approximately six days to reach maximal removal rates. All biofilters responded positively to the use of supplemental nutrients. *Plagiomnium cuspidatum* and coconut fibre biofilters were only able to remove toluene after the addition of nutrients. Once acclimated, the differences in the toluene removal efficiencies (percent removed per pass) for the moss biofilters could be attributed to the growth pattern of the mosses. There were no differences in the elimination capacity (removal per unit biofilter volume per unit time) of the different packing materials for toluene but the coconut fibre removed significantly more MEK.

#### **2D6p2 Filter efficiency of selected HVAC filters**

*ES Moyer, MA Commodore, J Hayes, and SA Fotta*

Air quality begins with good engineering air handling system (HVAC) controls. Air handler filters should remove the major particulate matter from incoming ambient air. A study of various NIOSH air handler bag filters was conducted to determine their filter efficiency against submicrometer particles (0.03-0.4 micrometers), since submicrometer particles are the most penetrating. Aerosol penetration measurements show an extremely large range of filter efficiency. New filter aerosol penetration ranged from less than one percent to greater than ten percent with penetration depending on flow rate, media surface area, and challenge agent particle size and state (liquid versus solid). Exposed filters (from air handler) showed a significant increase in submicrometer particle filter penetration and a shift in most penetrating aerosol particle size toward the larger particle size range. Both mechanical and electrostatic filters are used in HVAC applications. The electrostatic filters showed significant filter efficiency reduction over the filter's expected service lifetime.

#### **2D6p3 Real-time HVAC filter efficiency testing using optical particle counters**

*SP Berardinelli, SA Fotta, J Hayes and ES Moyer*

The National Institute for Occupational Safety and Health (NIOSH) has undertaken a long-term performance test of heating, ventilation, and air-conditioning (HVAC) system filters. This testing is being conducted at the NIOSH facility in Morgantown, WV in an air handling unit (AHU) that services the animal quarters. The six-pocket bag filters in this AHU have been replaced with higher efficiency mini-pleat V-Bank™ filters and have been monitored monthly for filtration efficiency. This study required the development of a method to determine the actual HVAC filtration efficiency using optical particle counters (OPCs) while the system was in operation. OPCs were used to collect particle counts in 15 different particle size ranges from 0.30-0.40 µm to >20 µm. Instruments are placed upstream and downstream of the filter bank and data were collected over several days. Filtration efficiency was determined for submicron to supernicron particles averaged over the sampling period.

#### **2D6p4 Performance characteristics of soaked air filters**

*K Kovanen and R Holmberg*

Several studies have shown that supply air filters in office buildings, schools etc. occasionally get wet due to weather impacts. The aim of this study was to investigate whether performance characteristics, such as pressure drop across the filter and filtration efficiency, change when two different kinds of air filters become soaked and dried. The filters used, were a fiberglass

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## *ABSTRACTS*

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