



Improving indoor air quality

Combining technologies to combat allergens, chemicals and other contaminants



Monday, March 24, 2014

By Mike Walrath

Improving indoor air quality (IAQ) in commercial buildings is a major issue for facilities professionals throughout Canada.

Sick building syndrome first surfaced in the 1980s with the move toward tighter, energy-conserving building envelopes. Generally, it refers to symptoms linked to time spent in a facility, and in particular, the off gassing of chemicals from fixtures and finishes including furniture and paint. Today, the syndrome is increasingly common.

What's more, new concerns related to airborne contaminants, such as hospital-acquired infections and severe acute respiratory syndrome (SARS) virus, have emerged. This is in addition to asthma, allergies, airborne chemical sensitivity and other reparatory ailments.

The HVAC industry has combines air purification technologies, including ultraviolet germicidal irradiation (UVGI) light, gas-phase air purification and, most recently, photo catalytic oxidation, in order to address these new and growing challenges. These technologies are most effective when installed in the HVAC system, which supplies, exhausts and re-circulates air throughout a building.

How UVGI works

UV light is grouped into three segments — UV-A, UV-B and UV-C — that range in frequency from 90 to 400 nanometres (nm). These frequencies all occur naturally in unfiltered sunlight. UV-A (320 to 400 nm) is used for black lights and tanning beds. UV-B (280 to 320 nm) causes sunburn.

UV-C (200 to 280 nm) is the most intense range. Because it is filtered out by Earth's atmosphere, microorganisms have never been exposed to UV-C and have no defence against it. UVGI technology uses UV-C light to scramble microorganisms' DNA so they cannot reproduce.

UVGI technology has also demonstrated an ability to reduce infectious airborne contaminants. It typically consists of UV lamps positioned near the air conditioning coils to disinfect microbes as they pass through the HVAC system.

UV-C light exposure can eventually kill viruses, bacteria, mold and other microbes, although effectiveness depends on exposure time and microorganism type.

Gas-phase air purification

UVGI kills airborne microbes, but it has no effect on purifying re-circulated HVAC air of volatile organic compounds (VOC) that are commonly found in commercial building maintenance cleaning chemicals, such as chlorine or d-limonene. They are also found in building materials that off-gas formaldehyde, acetone and other chemical vapours.

Outdoor air must be brought into commercial buildings via the HVAC system's re-circulation operation, as per ASHRAE Standard 62, in order to dilute these chemicals and maintain healthy IAQ. However, outdoor air also has its share of gaseous VOCs from vehicle emissions and other outdoor pollutants.

As a result, design engineers are specifying gas-phase air purification systems, which use activated carbon media placed inside the HVAC system's airstream to adsorb contaminants from both outdoor air and re-circulated air. The carbon-based material is derived from coconut shells, charcoal or wood chips. It adsorbs and holds VOCs through a chemisorption process, commonly known as gas-phase air purification.

However, the carbon media eventually reaches 100 per cent adsorption capacity and loses its effectiveness.

Photo catalytic oxidation

A fast-emerging technology, photo catalytic oxidation (PCO) can regenerate adsorbed gas-phase air purification media. PCO is a concept in which light, such as UV-C, stimulates a chemical reaction when shined on carbon media infused with titanium dioxide.

Because the PCO process is continuous, contaminants do not have time to accumulate and the carbon media never reaches adsorption capacity. In most cases, the activated carbon PCO media never needs replacement. Instead, the PCO process converts VOCs into harmless carbon dioxide and water vapour.

Today, many IAQ experts are combining UV-C light, gas-phase air purification and PCO to optimize the control of both biological and gaseous contaminants. All three technologies are produced by a variety of manufacturers and can be applied separately or combined into single source filtration units installed in new or existing HVAC systems.

Mike Walrath is a 15-year HVAC industry veteran and the sales engineer for the commercial products division of [Fresh-Aire UV](#). Fresh-Aire UV is an international manufacturer of UV systems, such as APCO, which combines microbial-killing UVGI, odor-removing gas-phase air purification and media-regenerating photocatalytic oxidation into one unit.