THE WORLD LEADER IN CLEAN AIR SOLUTIONS

Electronic Air Cleaners

Contaminant and Odor Control Performance Claims

SAAF TECHNOTE

The Marketing Hype

Marketed as the ultimate commercial filtration system, electronic air cleaners are advertised to control everything airborne, including; dust, allergens, molds, bacteria, odors, and volatile organic compounds (VOC). Electronic air cleaners appear attractive to designers and end users because they promise idyllic performance and low energy requirements due to lower air resistance compared to traditional, long proven mechanical air filtration.

There are several types of electronic air cleaners in the market today, but the most actively marketed use bi-polar ionization (BPI) and photocatalytic oxidation (PCO) technologies.

Bi-Polar Ionization

BPI systems are devices where two high voltage electrodes (commonly referred to as an "ionization tube") are used to excite electrons such that they start moving from one molecule to another, producing positive and negative air ions. This process is known as corona discharge. These "radical ions" are supposedly available to interact with various airborne materials, including particulates such as allergens and chemicals at the molecular level, and render them benign. The problem with ionization filtration is twofold: 1) the production of ozone, and 2) molecular interactions are uncontrolled with unknown byproducts.

Ozone production is a well-known byproduct of the BPI process and can be "spun" as a desirable product for controlling gaseous contaminants. In fact, devices are available that are specifically made to produce ozone for addressing severe odor issues to help remove smoke odor during fire restoration after a fire event. However, these devices come with warnings that the areas in which they are used are to be unoccupied when the device is in operation, and a time period of air flushing should be allowed prior to occupancy of the area.

Manufacturers of BPI systems will sometimes acknowledge the fact that BPI produces ozone (sometimes not addressed at all), but fail to provide quantitative data for the production of ozone. Instead, the production of ozone is often subjectively addressed with statements such as "low ozone generation" and "well below acceptable limits". It is well documented that ozone is indeed an ambient and indoor

contaminant that presents health risks to humans. The U.S. Environmental Protection Agency (EPA) has provided guidance on filtration device ozone production and the health effects of ozone exposure within the document "Ozone Generators that are Sold as Air Cleaners"*. The EPA guidance states, "There is evidence to show that at concentrations that do not exceed public health standards, ozone is not effective at removing many odor-causing chemicals."

Consequently, this presents a catch-22 situation; either the ozone needs to be generated at levels that represent a health exposure to occupants or the levels are too low claims of odor control are not valid. Either way, the production of ozone within or serving occupied spaces (especially in buildings where a susceptible population frequents such as daycares, nursing homes, and hospitals) should be avoided for the well-being of the building occupants.

In addition to the ozone issue, performance claims of BPI related to odor control and chemical filtration are unsubstantiated and often misleading. The reality is that this technology has not been proven as an effective gas-phase filtration system other than anecdotal testimonials of individuals associated with these devices. There are no peer-reviewed scientific studies documenting the effectiveness of BPI for the control of gaseous contaminants. In fact, studies have shown incomplete oxidation of VOCs resulting in stable toxic intermediates including aldehydes and haloacetic acids that are potentially hazardous contaminants and should not be introduced into the indoor environment.

PhotoCatalytic Oxidation

Devices utilizing PCO technology have been marketed for use in commercial buildings for airborne chemical contaminant control. These devices predominantly consist of an ultra-violet (UV) light source which provides the

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necessary energy for a catalytic reaction to occur with a catalytic material (typically titanium dioxide). The UV light source is used to generate an energy field with enough energy to initiate photocatalysis or PCO.

PCO devices have been pushed in recent years promising eraditction of gaseous contaminants. The sales pitch over traditional granular gas-phase filtration is very attractive with virtually zero pressure drop and no need to replace chemical media. However, manufacturers of these devices are not being completely forthcoming with respect to the degree of complete oxidation of the reactions that take place. The fact is, there are compounds that often do not fully oxidize leaving byproducts that can be potentially hazardous to people.

Follow the Science

The American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) is currently researching PCO technology for use as commercial filtration devices. ASHRAE found sufficient evidence suggesting unknown byproduct contaminants to fund a research project (ASHRAE RP-1457) to assess byproduct production from PCO devices. In addition, research conducted by Al Hodgson et al. at Lawrence Berkeley National Laboratories found byproduct formation from a PCO device that was exposed to gaseous mixtures typically encountered within commercial indoor environments. The byproducts included aldehydes, acetone, and acetic acid which are considered indoor contaminants.

Despite concerns, PCO filtration in commercial buildings is being promoted as a safe gaseous contaminant removal process. Building designers and engineers are well advised to limit the use of PCO technology to industrial applications and not in commercial buildings until this technology has been fully researched and proven to be safe from potentially dangerous byproducts.

BPI and PCO technology have been in use for air cleaning for many years in the industrial market where the objective is not for the well-being of building occupants but rather the reduction of specific contaminants due to process concerns. There are limited scientific studies and peer reviewed publications that should be referenced as verification of manufacturer's performance claims for commercial applications.

Proven Gas-Phase Technology

Air filtration options are accessible for commercial applications when source control of gaseous contaminants is not available or practical. The long proven dry scrubbing filtration technology is the best recommendation to actually capture and retain gaseous contaminants similar to traditional particulate filtration. This technology uses adsorption and chemisorption processes where gaseous contaminants are either adsorbed into highly porous activated carbon or chemically react with a chemically impregnated highly porous material.

The impregnation is often an oxidizer which is used as an argument by electronic air cleaner advocates to bolster their technology as being similar to the ionization process, since both involve a chemical reaction process. However, the chemical reactions associated with the dry scrubbing technology are a controlled process which occurs on and within the granular material and is subsequently discarded when the dry scrubbing media is spent.

Electronic air cleaners simply provide the conditions for chemical interactions which then take place when passing through the device as well as downstream of the device and into the occupied space.

AAF Proven SAAF Solutions

AAF's gas-phase filtration product solutions incorporate traditional dry scrubbing technology. These products have been successfully used in many commercial environments for controlling specific contaminants. They are also used in general odor control applications such as diesel exhaust, food odors, and controlling jet fuel combustion exhaust odors associated with hospital helipads and airport terminal buildings.

Dry scrubbing gas-phase air filtration systems are proven effective at removing a myriad of chemical contaminants from the air and do not produce or release unwanted and potentially hazardous chemicals or reaction byproducts into the air.

Until manufacturers of BPI systems can prove, via published peer reviewed testing results, that the normal operation of their systems do not produce harmful materials such as ozone and do not produce dangerous reaction byproducts such as aldehydes; building owners, managers, and designers are encouraged to assume that their claims for the safe control of airborne gaseous contamination are overstated at best and fabricated at worst.

For application based expertise controlling particulate and gaseous contaminants contact AAF at 888.223.2003
www.aafintl.com

*"Ozone Generators that are Sold as Air Cleaners" is available online at http://www.epa.gov/iaq/pubs/ozonegen.html

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