Cleaning the Air 101

By Ronald G. Fink

The goal of air purification is to remove contaminants from the air we breathe. Considering we breathe 23,000 times a day and move around 435 cubic feet of air, this is a major concern. Indoor air pollution is now considered by the EPA and Congress to be America's #1 environmental health problem. Mold once considered just an unpleasant byproduct of nature is now believed to be the cause of many respiratory diseases. Most colds and viruses are caught indoors by inhaling in airborne germs. Indoor air pollution, left unchecked, can lead to sick building syndrome. With today's technology, indoor air pollution is no longer a necessary evil of today's tightly built, energy saving buildings.

Symptoms, Pollutants and Technologies

Indoor air pollution has a wide scope of symptoms, which generally include the following:

- Headaches
- Fatigue
- Eye Irritations
- Asthma Attacks
- Breathing Problems
- Dizziness
- Memory Loss
- Depression
- Skin Irritations
- Sinus Infections
- Colds, Flu and Viruses

The traditional method of indoor air filtration is to force the room air through a HVAC duct filter, usually consisting of simple fiberglass or open-cell foam fibers, that is capable of removing only particulate matter over 10 microns in size. Microbes and polluting gases pass right through the filter and, in fact, the dust and dirt build-up on the filter can act as a breeding ground for bacteria, mold and fungus.

In order to properly decide on an air purification device, one must first identify the problem and then prescribe the technology for the solution. Indoor air pollution consists of three major categories:

1. **Particulates** - These consist of minute solids drifting in air currents. The particulates consist of dust, dander (skin flakes), soot, pollen, and smoke particles. Size range: .001 to 1,000 microns.

2. **Microbes** - These are bacteria, germs, viruses, fungi, spores and mold. Size range: .001 to 10 microns.

3. **Gases/Odors** - Indoor gases, such as benzene, formaldehyde, chloroform, hydrogen sulfide, ammonia, etc., are released from furniture, cabinets, carpets, cleaning chemicals, copy machines, insulation, insect sprays, hair sprays, etc. Size range: .0001 to .001 microns.

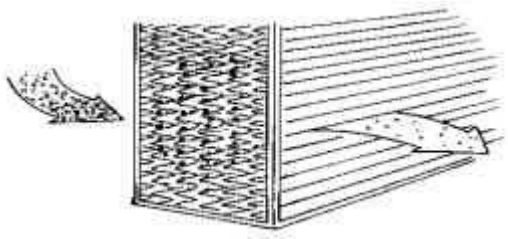
Air filtration technologies consist of the following:

- Filter (Mechanical)
- Ionizers
- Ozone Generators
- Ultraviolet Light Rays

FILTERS

In general, filters must permit some pollutants to pass with the airflow. The higher the efficiency or density of the filter, the lower the air flow and higher restriction to the blower.

HEPA Filters:

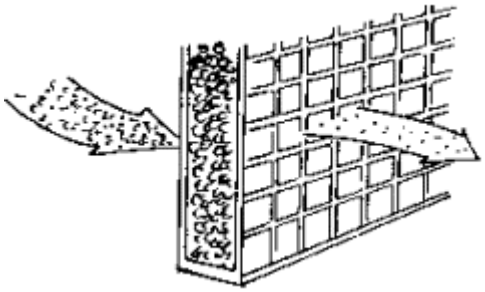


HEPA stands for *high efficiency particulate air filter.* HEPA filters utilize a powerful blower to force the air through a very tight membrane to achieve high efficiency particulate filtration.

Pros: They are very efficient in the filtering of air that passes through the filter. They filter to .03 micron.

Cons: They require filter changes. The filter can act as a breeding ground for bacteria, mold and fungus. They do not remove odors, gases, pesticides, viruses, and many bacteria. They reduce airflow due to the tight pores of the filter. They are generally not used in central systems, and sold as stand-alone units only.

Carbon Media Filters:



Carbon filters consist of carbon impregnated filter fabric or granulated carbon. These filters usually have a foam or fabric filter to hold the media. Carbon has the unique capability of acting as a physical filter trapping particulate, and on a chemical basis by reacting with some odors and some of the heavy gases.

Pros: Absorbs odor, absorbs some gases, filters particulate, installed in central or individual rooms

Cons: Requires frequent changes, acts as a breeding ground for microorganisms, can easily become blinded and ceases functioning. They reduce airflow.

Fiber/Foam Filters:

Fiber or open-cell foam filters rely on the air passing through a matrix of foam cells or fibers of fiberglass, wire, plastic or cloth. Typically, these filters only stop medium to large particulate.

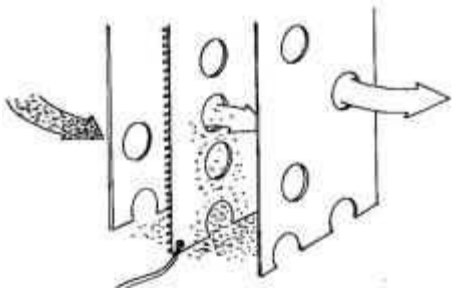
Pros: Low cost, low air resistance, installed in central units

Cons: They only filter the air that passes through the filter. The particle build-up can act as a breeding ground for bacteria. They only filter medium to large particulate.

IONIZERS

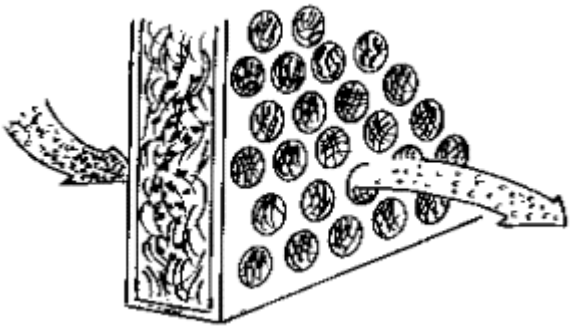
Electrostatic Precipitators:

Electrostatic Precipitators have been used by industry for many years to clean up smokestack emission of particulate. They operated by electrically charging a field between metal plates. The air is charged with an electrical charge similar to static electricity. The charged particulates collect and coagulate on a second set of charged plates where they build up and fall to a collection tray.

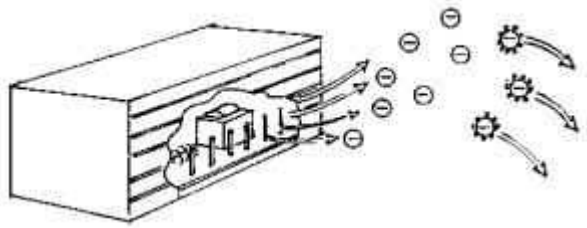


Pros: They are very effective on removing smoke from the air that passes through the filter. They do not reduce airflow as most other filters do. They can be installed in central units or in each room.

Cons: They require frequent cleaning. They only filter the air that passes through the filter. The particle build-up can act as a breeding ground for bacteria.



Negative Ion Generators:

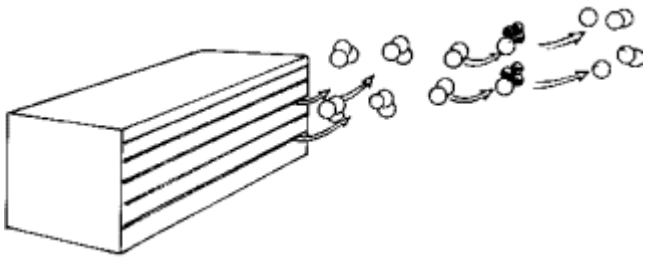


Negative ion generators have been used by industry for years to remove particulates from the air and to neutralize the effects of excess positive ions. Negative ions are produced electrically and travel through the air until they attract airborne particulate and coagulate the particulates until they are too heavy to drift and settle to the floor.

Pros: They are very effective on removing smoke from the air. They travel throughout the entire room and purge all the air of particulate, not just the air that passes through a filter.

Cons: They drop the particulates to the ground. They must be in each room as the ions cannot effectively travel through HVAC ducts.

OZONE

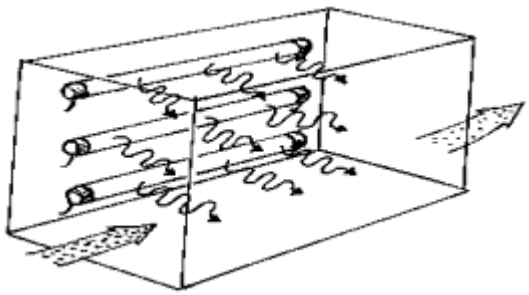


Ozone is a gas of oxygen — an oxygen molecule containing three atoms instead of two, like the oxygen we breathe. The extra atom of ozone is known as a loose radical that looks for organics to attach to and thereby oxidize. Ozone is known as a friendly oxidizer due to the fact that it reverts back to oxygen after oxidation occurs.

Pros: Ozone is an oxidizing gas that travels throughout the room and oxidizes all organics. Ozone can neutralize odors and gases. Ozone destroys microorganisms and does not reduce airflow. Ozone units can be installed in central units or in each room.

Cons: Ozone has no effect on particulate solid particles. Ozone exposure levels must be controlled.

ULTRAVIOLET LIGHT



Ultraviolet light rays have been used as a sanitizer by the medical profession for years. Ultraviolet light can also sanitize air that is passed directly in its path.

Pros: Ultraviolet light can destroy bacteria, fungus, molds and some gases. It does not reduce airflow. Can be installed in a central or individual room unit.

Cons: Ultraviolet light has no effect on particulate, needs direct close contact with a calculated exposure time. Ultraviolet light rays must be shielded from human exposure.

SUMMARY