Cleaning the Air We Breathe

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Indoor Air

Have you ever wondered what is contaminating the air inside your home or office? The concentration of indoor pollutants regularly exceeds those of the outdoors. Indoor air contains allergens, such as pollen, humans and animal skin cells, mold, dust and dust mites. In addition, viruses and bacteria float in the air by attaching to particles and moisture. Another group of airborne pollutants that are particularly problematic in the indoor setting are volatile organic compounds or “VOCs” [1-2].

Now that you know what is in the air, let’s explore them in more detail:

Allergens

Pollen, skin cells or “dander”, mold, dust and dust mites are some of the most common allergens. They can cause mild symptoms like itchy eyes, runny nose and itchy throat in some people. In others, the symptoms can be severe, leading to respiratory problems such as wheezing, shortness of breath and asthma attacks [3]. You may have noticed pollen as a fine powdery dust on your indoor and outdoor surfaces.

Mold

Mold is commonly found in the indoor setting. Areas of moisture, such as bathrooms and kitchens, are most prone to mold growth. Mold may be visible, but it may also live in the walls, ceilings and other hidden areas of a home or office. Spores travel in the air and can cause sneezing, runny nose, cough, itchy eyes and rash [4]. Mold also releases gases called microbial volatile organic compounds, or MVOCs. For people with asthma or other respiratory problems, mold can cause worsening of their symptoms [3]. You may have seen mold in your shower or bath as dark spots along caulk and grout lines.

Viruses

There are many airborne viruses that we are exposed to on a regular basis. The seasonal flu and the novel coronavirus disease, known as COVID-19, show us how easily viruses are transmitted through the air [5]. These viruses infect humans by entering the eyes, nose and mouth. Viruses cause a plethora of symptoms in humans such as fever, sore throat, cough, shortness of breath and body aches. If you have ever had a cold or the flu, you have experienced a viral infection.

Bacteria

Common bacteria found in indoor air include Micrococcus, Staphylococcus and Streptococcus [6]. These bacteria live on human skin. In some individuals, these bacteria can cause infections with symptoms such as fever, sore throat and sores on the skin. In people with weakened immune symptoms, these infections can be much worse.
Volatile Organic Compounds

VOCs are gases which are emitted from certain solids and liquids. These gases can come from paint, varnishes and waxes commonly used on walls, furniture and flooring [2]. They can come from cleaning and disinfecting products, cosmetics, degreasing agents and hobby products, like glue [2]. Some building materials such as laminate flooring emit VOCs. One relatively harmless VOC you may know about is ethylene. It is the sweet smell that comes from bananas and is responsible for helping the fruit ripen. It is used in the food industry to ripen fruits faster [7].

What Can We Do to Clean the Air?

Many air filtration systems are available that filter particles from the air. Filters are assigned a “minimum efficiency reporting value”, or MERV, which determines how well the filter captures particles. The value ranges from 1-16. Filters with a higher MERV filter out smaller particles. Filters with a low MERV offer no benefit to small particulate filtration and might worsen the problem by capturing and dumping particulates downstream [8]. All fibrous filters gradually become full of what they capture - like pollen, mold, pet hair and dust. The user is required to change out the filters on a regular basis to ensure that the system functions properly [8].

A more advanced way to purify air is called photocatalytic oxidation. Photo means light, and catalyst means something that helps a reaction happen. This type of system uses ultraviolet light in the lowest spectrum of wavelengths, called UVC, to shine on a surface coated with titanium dioxide alone or with other metals. The ultraviolet light causes a reaction on the surface causing a release of negatively charged hydroxyl radicals called anions. These anions react with the particles in the air and cause them to break down [9-10]. An air purification system that uses photocatalytic oxidation is able to remove particles from the air by actually eliminating them as they pass into the light chamber.

Photocatalytic oxidation systems are currently used in industrial settings, office buildings and in food facilities. Remember the bananas we talked about earlier? The food industry uses photocatalytic oxidation to remove ethylene from the air to help produce last longer [11]. They also use these systems to remove bacteria, mold and viruses that can cause food spoilage and food-borne illness. Businesses use photocatalytic oxidation systems to keep their employees healthy by preventing “sick building syndrome.” This is when employees feel acute health effects that seemed to be linked directly to the time spent in the building [12].

A photocatalytic oxidation air purification system can be used anywhere indoors where people live, work and play. These systems are now available in smaller sizes to be used inside personal living spaces [13]. Photocatalytic oxidation systems are highly effective and easy to use. We all now have the ability to purify the air we breathe.
References:

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