Do air purifiers really work? Myths and facts debunked

Ionizers, ozone zappers, UV lights...what can you believe about the many claims of air filter and air purifier manufacturers?

The home air purifier market has undergone many shifts and starts in its decades-long history as an affordable solution for indoor air quality. Along with those shifts have been seemingly groundbreaking advancements in filtration technologies that may seem like the next revolution in air purification.

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So how do you know who to trust? Let's take a fact-based approach to the industry and find out what's beneath the marketing sweet talk.

What should I look for in an air purifier?

Before you can look at some of the more questionable claims out there about air purifiers with a critical eye, it's essential to have a solid understanding of what does make a good air purifier.

1. HEPA filters are the standard for the industry.

First things first: just what is a HEPA filter?

High-efficiency particulate air (HEPA) filters capture airborne particles from moving air using a dense, random arrangement of fibers. In essence, HEPA filters use the physics of particles moving through air to yank them out of the air flow. Their operation is simple but super effective, and HEPA filters are now standard issue for almost every air purifier on the market.

But it wasn't always that way.

Air purifiers have been around for well over a century. The first air purification systems appeared in the 1850s in charcoal-based masks used by coal miners to keep toxic dust out of their lungs. The technology was so successful that, less than twenty years later, respirators were added to these types of masks to protect firefighters from breathing in chemicals in smoke.1

Then, beginning in the 1940s, the United States Atomic Energy Commission started experimenting with high-efficiency particulate arrestance, better known now as HEPA, as a method of shielding soldiers from atomic radiation on World War II battlefields.2

HEPA filters did nothing to filter radiation particles, but researchers quickly learned that HEPA filters could filter out many harmful pollutants. In 1963, Manfred and Klaus Hammes, the founders of IQAir, introduced the world's first residential air filter based on HEPA technology, helping reduce indoor pollution as well as chronic asthma symptoms. Not long after, HEPA became so widespread that the U.S. Department of Energy (DOE) required that all filters sold under the name "HEPA" must filter at least 99.97% of airborne particles down to 0.3 microns.3

Since then, HEPA air purification has become the standard for the air purification industry. HEPA is now thrown around as a generic term for air filters, but HEPA filters continue to filter 99.97% of particles down to 0.3 microns.

> ***The HyperHEPA filter builds upon the HEPA model to create even more efficient filtration systems.***

Many manufacturers, including IQAir, have built upon the HEPA model to create even more efficient filtration systems. IQAir's patented HyperHEPA filter is one such filter. HyperHEPA filters remove 99.5% of particles down to 0.003 microns, which are 10,000% smaller than the DOE's required 0.3-micron particle size.

2. Not all air purifier designs are created equal.

All air purifier manufacturers know that their filters need to live up to this HEPA standard. Even the newbie air purifier buyer believes that HEPA=good because of these long-standing, strict guidelines around air filters. And in theory, that's correct.

To advertise an air purifier as HEPA, it only needs to contain HEPA paper, the paper used to construct a HEPA filter. Whether the air purifier's Total System Efficiency meets HEPA requirements is another story. In fact, most HEPA air purifiers are not tested for total efficiency.4

The hidden factor at work here is leakage. Despite the high efficiency of many HEPA filters, the housing designs of many air purifiers are not airtight, meaning that dirty, unfiltered air passes around the HEPA filter through tiny openings, cracks, and space around the frame of the HEPA filter itself or between the frame and the purifier housing.5

So even though many air purifiers claim that their HEPA filters remove nearly 100% of particles from the air that passes through them, they're only telling part of the story. In some cases, the actual efficiency of the whole air purifier design, with leakage considered, is closer to 80% or less.6

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Some air purifier manufacturers have resolved this issue with designs that are built to minimize or eliminate leakage. IQAir uses patented 3D UltraSeal knife-edge-in-groove sealing between the filter frame and the purifier housing to guarantee the full efficiency of our HyperHEPA filtration media.

3. Got gas? Go beyond HEPA.

HyperHEPA filters are great at getting particles out of the air, but despite any claims you may have seen, HyperHEPA filters do NOT take gases and odors out of the air.

Unlike particles, the molecules that comprise gases, odors, and volatile organic compounds (VOCs) are not solid and will float through even the densest HyperHEPA filters.

That's where activated carbon filters come in. Remember them from early air filtration experiments back in the 1800s? They're still alive and well.

How do these filters work? It's simpler than you might think:

Chunks of carbon material (like charcoal) are exposed to high concentrations of oxygen.
Countless pores open on the carbon surface, increasing the carbon surface area enormously. At this point, a pound of activated carbon can have the same surface area as 100 football fields!
Several pounds of activated carbon are arranged in a flat "bed" and packaged in a proprietary filter design (such as IQAir's V5-Cell gas & odour filter).
Air passes through the activated carbon bed.
Gas, chemical, and VOC molecules are adsorbed into the carbon pores, meaning that they chemically bond to the extensive charcoal surface area.
Activated carbon adsorption is the go-to method of filtration for gases as well as chemical pollutants from vehicle emissions and combustion processes.[7,8]

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Some air purifiers are designed to maximize activated carbon in case you're more concerned about, for example, gases from cooking or odors from pets than about particle pollution in your home. IQAir's GC MultiGas is built for such a purpose–while carbon filters generally use a few pounds of carbon, the GC MultiGas contains 12 pounds of activated carbon as well as impregnated alumina, providing well over 1200 football fields worth of surface area for gas and VOC molecules to adsorb to.

The Takeaway

Now you know that the elements of a good air purifier are simple:

- **HyperHEPA** media for particle filtration
- **No system leakage** due to sealed filter and purifier housing
- **Activated carbon** for gas and odour filtration

But we're not done yet. Just as important to know is what NOT to look for in an air purifier.

What should I avoid in an air purifier?

Several categories of air purifiers, some of them rather popular, are not to be trusted for their exaggerated air cleaning claims.

The science behind their technology isn't necessarily inaccurate. In fact, some of these air cleaning methods do have limited capabilities of removing particles and other pollutants from the air.

But inefficiencies and hidden costs to your health should more than raise your eyebrows while you're perusing the shelf for your next air purifier purchase.

Air Ionizers

Ionizers are purported to purify air by sending out negatively charged ions (anions) that attract positively charged pollution particles (cations), causing them to leave the air and stick to surfaces like ceilings, walls, and furniture.

Many popular air purifiers use ionization technology, also called negative ionization, as a central component of their operation. Research suggests that ionizers can help stop potentially infectious molds and bacteria from spreading in sterile environments like dental clinics and hospitals.[9,10]

But there are two critical downsides to ionization for the home:

- **Ionizers don't get rid of pollutants**. Particles charged by negative ions aren't removed from the air–they merely stick to surfaces nearby. This includes surfaces inside your airways, such as your windpipe and alveoli, the sacs of air in your lungs. Pollutant build-up can cause heart, lung, and other respiratory conditions.

- **Ionizers can generate harmful ozone**. Ionizers produce ozone (O_3) that can build up to dangerous levels indoors. At even low levels, indoor ozone can irritate your airways, trigger asthma attacks, damage your olfactory bulb (the organ that helps your brain process odors), and even be fatal at high concentrations.[11,12]

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Verdict

Don't buy an air purifier with an ionizer. They don't remove particles from the air, and the ozone they produce can have harmful side effects, even if the purifier claims that they only charge the particles "a little bit."

Ozone Generators

It's worth saying again: ozone is TERRIBLE for you, especially indoor ozone build-up.

That's why the air purifier industry has united almost all-encompassingly against the sale and use of so-called ozone generators. Even the California Air Resources Board, a government agency, has taken measures to warn people about the harm they can cause.13

Ozone generators use a process called corona discharge to release ozone molecules into the air. When an ozone molecule intermingles with a particle or gas molecule, an ozone atom clings to the other molecule and blows it up in a process known as oxidation. Oxidation in the atmosphere after a lightning strike is also what makes the air smell so distinct after a thunderstorm. It's also why many ozone "air purifiers" are sold with catchy names that evoke thunder, lightning, and rain.

But don't fall for the hype–despite the "fresh" smell, ozone generators do little to clean air and are quite bad for you. Here's just a short (and far from complete!) list of reasons why:

- **Ozone can take years** to fully clear even a small room of gases.14

- **Ozone reactions can introduce ultrafine particles (UFPs) into the air.** UFPs can get into your lungs and your bloodstream, causing heart disease and even stunting lung development in children.15,16

- **Indoor ozone levels can rise five to ten times above recommended limits**, which range from 0.05 to 0.1 parts per million (ppm), because of a lack of ventilation and in combination with outdoor ozone that seeps indoors.17 To put this in perspective, those who are sensitive to ozone, such as children, people with asthma, and pets, start experiencing health effects at only 0.01 ppm, so even a "safe" ozone generator that emits a small amount of ozone can quickly trigger potentially life-threatening ailments like asthma attacks.18

Verdict

Don't buy an ozone generator. They're NOT air purifiers. They not only fail to clean your air but also hurt you and the most vulnerable in your home: your children and your pets.

UV Light Purifiers

Ultraviolet (UV) light is often used to disinfect equipment in hospitals and prevent the spread of harmful strains of bacteria and viruses.[19,20]

One of the most common UV purification methods is called ultraviolet germicidal irradiation (say that three times fast!), or UVGI.

In UVGI, intense UV lights are shined on bacteria and viruses, damaging their DNA beyond repair. Bacterial cells and viruses then shut themselves down because they can no longer function. This is called apoptosis, or programmed cell death, which effectively destroys their ability to cause infections.[21]

But UV air purification isn't all it's cracked up to be. Here's why:

- **Bacteria and viruses need to be exposed to UV light for a certain amount of time** before they're rendered harmless: some strains need to be treated with UV for several hours in direct UV light before they're destroyed.[22] Home UV air purifiers don't shine UV light on them long enough to be genuinely useful.

- **Some bacteria can come back to life** and become infectious again even after being disinfected by UV light.[23]

- **UV lights do nothing for pollutant particles**.[24] Air treated with UV light can still be full of harmful particulate matter.

- **Many UV air purifiers produce ozone.** And what did we say about ozone? That's right: it's BAD.

- **UV light can burn your skin and damage your eyes.** Sure, most UV purifiers block the light from shining out of the purifier, but even brief UV exposure can cause permanent skin and eye damage as well as cancer.[25,26]

> ***Air treated with UV light can still be full of harmful particulate matter.***

Verdict

Don't buy a UV light air purifier. UV light somewhat disinfects but doesn't purify air, and research shows that UV's disinfection potential for air may be exaggerated.

Now What?

Not all the claims out there about air purification are founded upon sound science. At this point, you should feel like you have a good sense of what's fact and what's fiction when it comes to truly effective air purification.

So what should you do now, armed with your knowledge of what makes a good air purifier? You have a multitude of options for maximizing your Indoor Air Quality without having to endure all the marketing fuss:

- **Get a HyperHEPA air purifier**. All the air purification science backs HEPA filtration as the safest, most trustworthy method of indoor air purification. IQAir goes the extra mile with the HealthPro 250™, built around our patented HyperHEPA filtration technology that removes 99.5% of pollutant particles down to 0.003 microns, the smallest particles in existence.

- **Use advanced gas-phase filtration**.
  - The HealthPro 250 features our patented V-5 Cell gas and odour filter, which eliminates harmful chemicals and compounds with five pounds of activated carbon.

  - The GC® MultiGas features 12 pounds of activated carbon and impregnated alumina to protect you against indoor gases and chemicals, in addition to our powerful HyperHEPA particle filtration.

- **Use a personal air purifier.** Whether you're traveling for work or just going down the street to work at a coffee shop, you never know what's going to be in your air. IQAir designed the Atem™ personal air purifier precisely for that reason. The Atem is equipped with HyperHEPA filtration technology and a PureJet diffuser that instantly blankets you in clean air. And it's sleek, compact, and portable, allowing you to breathe virtually pure air anytime, anywhere.

- **Install a whole-house air purifier.** Your heating, ventilation, and air conditioning (HVAC) system at home uses outdoor air to heat and cool your home, so even with an indoor air purifier, your air still might become polluted by outdoor particulates on days with poor air quality. The Perfect 16® whole-house air purifier is equipped with the most powerful HyperHEPA filters available for residential purification systems, and it fits seamlessly into your existing HVAC system, ensuring that air entering your home is always up to the highest possible standard of quality.

> ***The most capable air purification technology isn't surrounded by jargon and gibberish.***

Just remember that the most capable air purification technology isn't surrounded by jargon and gibberish. When it comes to choosing the best air purifier, science has got your back.

FOOTNOTES

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